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THE BUILDING LOADS ANALYSIS SYSTEM THERMODYNAMICS (BLAST) PROGR--ETC(U)
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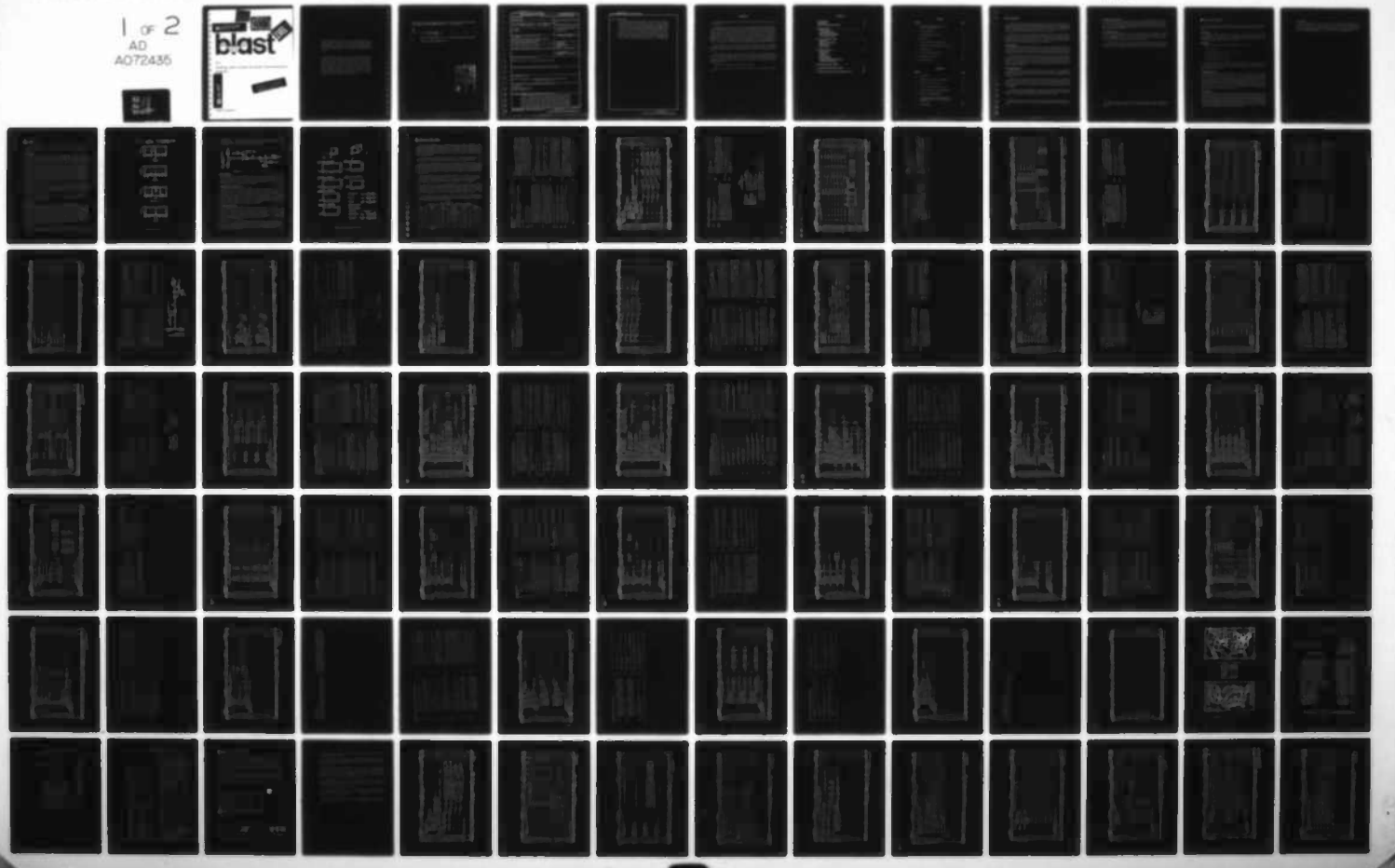

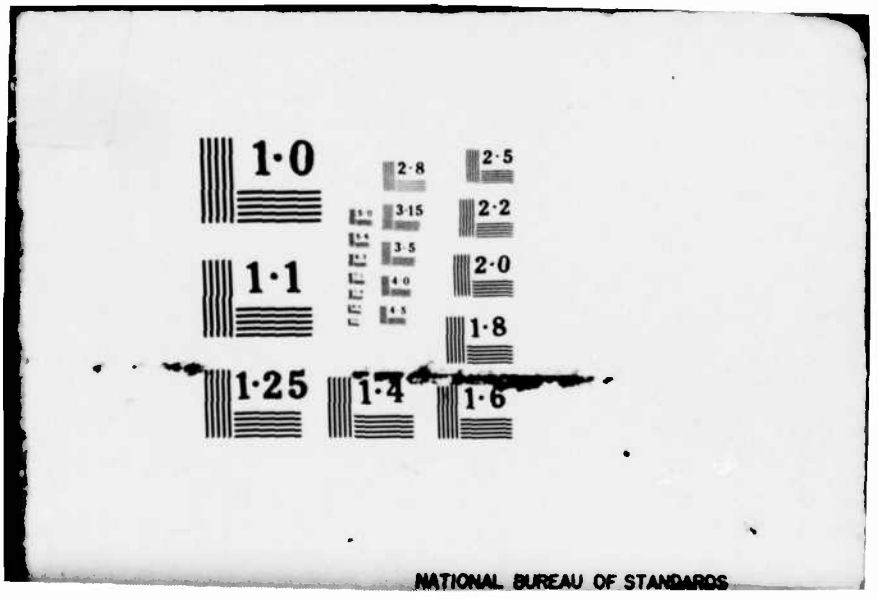
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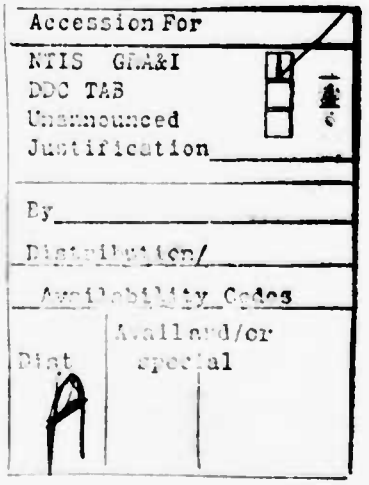
Errata sheet for Technical Report E-154, "The Building Loads Analysis System Thermodynamics (BLAST) PROGRAM, VERSION 2.0: Input Booklet."

Page	
27 & 29	line 6, change ORIGIN: X = , Y = , Z = ; to ORIGIN: (, ,);
45	Delete all handwritten text i.e., form should be blank Input Form.
46	Delete all hyphens between words.



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The Building Loads Analysis and System Thermodynamics (BLAST) program is a comprehensive set of subprograms for predicting energy consumption in buildings. There are three major subprograms: (1) the space load predicting subprogram, which computes hourly space loads in a building or zone based on user input and hourly weather data; (2) the air distribution system simulation subprogram, which uses the computed space load and user inputs describing the building air-handling system to calculate hot water or

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steam, chilled water, and electric energy demands; and (3) the central plant simulation program, which simulates boilers, chillers, onsite power generating equipment and solar energy systems and computes monthly and annual fuel and electrical power consumption and plant life cycle cost. The program is written in Control Data Corporation (CDC) FORTRAN Extended, Version 4, and can be used on CDC 6000/7000 series computers with few or no modifications. Volume I of this report provides detailed user instructions, and Volume II contains a listing of the basic BLAST program library and a BLAST example. The Input Booklet explains each entry on the BLAST input forms and provides a complete input form example for a sample BLAST run.

FOREWORD

This Input Booklet was developed by the Boeing Computer Services Company under contract DACA-78-F-0195.

The BLAST program was developed by the U.S. Army Construction Engineering Research Laboratory (CERL) under the sponsorship of the Air Force Engineering and Services Center (AFESC) Tyndall Air Force Base, FL, and the Department of the Army, Office of the Chief of Engineers (OCE) Washington, D.C. Subsequent to its original release in December of 1977, extensions and improvements to the BLAST program were made under the sponsorship of the General Services Administration, Office of Professional Services. These improvements have led to the release of BLAST Version 2.0. This input booklet provides instructions and forms for preparing input to BLAST Version 2.0 only. The development of this Input Booklet and a companion BLAST Users Manual was sponsored by AFESC under the Investigation Engineering Program (ENE-78IE 042).

Mr. Fred Beason was the Air Force Technical Monitor. Mr. Douglas C. Hittle was the CERL Principal Investigator. Administrative support was provided by Mr. D. J. Leverenz and Mr. R. G. Donaghy, Chief of CERL's Energy and Habitability Division. Their assistance is gratefully acknowledged.

Substantial revisions to the original program (known as BLAST 1.2) leading to BLAST Version 2.0 were accomplished by Mr. Dale Herron, Mr. George Walton, Ms. Linda Lawrie, and Mr. John Cameron. The success of BLAST and the hoped-for success of BLAST Version 2.0 are due in large measure to their special skills and determination. Ms. M. L. Scala was the consulting editor on this BLAST Input Booklet.

COL J. E. Hays is Commander and Director of CERL and Dr. L. R. Shaffer is Technical Director.

CONTENTS

TABLES

FIGURES

1 INTRODUCTION

This booklet is intended to help the user prepare an input data deck for the BLAST computer program. It can either be used with the BLAST Users Manual[1] or separately; forms included in this booklet illustrate proper BLAST input and minimize the effort required to create a complete input deck ready for keypunching. It is important to note, however, that not all forms are required in any single run; the booklet indicates which are required for particular situations.

Since BLAST has a "free-format" input language designed for describing buildings and their energy systems, the input forms in this booklet are not mandatory. Users can also describe their building on ordinary keypunch code sheets; in this case, coding may be done without regard to the location of items on the data cards. Punctuation and syntax are important, however, and the examples in this booklet follow the rules detailed in the Users Manual.

BLAST Overview

The BLAST program uses the description of the user's building and its energy systems to perform simulations and thus predict the building's energy requirements. Ideally, this analysis will take place early in the design cycle and several variations will be explored by successive runs of the program to determine optimum design. BLAST can also evaluate proposed retrofits to existing buildings.

During BLAST simulations, building heating, cooling, base electrical loads, and domestic hot water loads are determined hourly for either selected design days or specified long-term weather sequences. These loads are met by delivery and energy conversion equipment specified by the user. Final results are reported in terms of monthly and annual energy requirements, and in terms of economic factors (including life-cycle costs). Useful intermediate results include peak values which will aid in selection of equipment.

Input Booklet Overview

This booklet contains a step-by-step description of how to perform a successful BLAST building analysis. It also describes data gathering and Drawing Take-Off in a way which should be adequate for persons already somewhat familiar with building documents and building HVAC systems (Chapters 2 and 3).

Chapter 4 contains a sample of each of the BLAST input forms; each entry on the forms is explained. The user is encouraged to reproduce and use the blank forms provided in Chapter 4 to describe an actual building. If the user prefers, pads of input forms (which are slightly larger than those reproduced here) can be used. These pads are available from computer service bureaus supporting BLAST.

A simple but complete example BLAST run is contained in Chapter 5. This example does not, however, demonstrate all the capabilities of the BLAST program; the flexibility of the BLAST program cannot be fully appreciated without a careful study of the Users Manual.

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[1]Hittle, D. C., *Building Loads Analysis System Thermodynamics (BLAST) Users Manual, Version 2.0*, Volumes I and II, Technical Report E-153 (U.S. Army Construction Engineering Research Laboratory [CERL], June 1979).

Other BLAST Documentation

The principal reference document for BLAST users is the BLAST Users Manual, Version 2.0,[2] available from the National Technical Information Service and from several computer service companies. The Users Manual provides detailed descriptions of BLAST input instructions and gives a general description of the BLAST language (which will be found to allow much more flexibility than is suggested in this Input Booklet).

Units and Default Values

At the user's option, BLAST accepts input and provides output in either English or a slightly modified set of SI units. If the user selects input as English, *all* inputs are expected in this set; alternately, if METRIC is selected, *all* inputs are expected in SI. In this booklet, English units are shown and METRIC units are given in parentheses for each input item.

Many BLAST input items have default values (listed in the Appendix) which are used if the user does not provide the information. The user should consider these values carefully before accepting them, since their validity is often dependent upon the particular building being simulated.

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[2]Hittle, D. C., *Building Loads Analysis System Thermodynamics (BLAST) Users Manual, Version 2.0*, Volumes I and II, Technical Report E-153 (U.S. Army Construction Engineering Research Laboratory [CERL], June 1979).

2 DATA GATHERING PHASE

Accurate energy analysis of a building requires a significant amount of supporting information. BLAST analysis will proceed more efficiently if these data are gathered early and in an organized manner.

Weather Data

Occasionally, weather tapes required for a typical year analysis are not available from the user's computer service company, and must be ordered from the National Climatic Center (see Users Manual, Volume I, Appendix A). To avoid significant ordering delays, the user should check weather data availability early in the data gathering process.

Building Data

BLAST analysis requires a complete set of building construction documents:

1. Architectural plans

2. Sections and section details for walls, ceilings, etc.

3. Mechanical plans for the air systems

4. Mechanical plans for the central plant.

The specification document, if available, will often provide details not on the plans. If greater accuracy in equipment simulation is desired, manufacturer's literature on the central plant equipment, cooling coils, and fans can be obtained from the mechanical engineer on the design team or the manufacturer's representative.

Operational Information

Information on how the building is operated and used (e.g., equipment operation schedules, occupancy vs time, lighting schedules) is required and is usually available from the architectural team (new building) or from the owner, occupant, or operating personnel (existing building). In many existing commercial and institutional buildings, internal loads such as lighting, electrical, or fuel-operated equipment will dominate the air-conditioning load and therefore the energy consumption. This information must be specified carefully during BLAST input; a room-by-room survey should be made, since energy loads often change as building usage changes (e.g., lamps may have been removed from the lighting fixtures). For a building under design, the electrical and mechanical plans and specifications will provide operational data.

Economic Data

If accurate economic analysis is required, new or replacement costs for all the building's mechanical equipment should be obtained from manufacturer's representatives. Economic data such as interest rates and project life are usually established by policy and can be obtained from the financial officer of the owning organization. Costs of fuel and other energy sources are available from the prospective supplier or utility company (new building), or from past utility bills (existing building). Inflation and cost escalation data are extremely difficult to obtain with accuracy; since these data can sometimes strongly affect economic comparisons, they should be approved by the financial officer of the owning organization before they are input to BLAST.

BLAST Library

The exact information required for BLAST analyses are illustrated in the examples in this booklet. If some information is simply not available (e.g., early concept studies), typical characteristics such as wall sections and schedules may be referenced by name from the BLAST library. A copy of this computer-stored library is included in Volume II of the Users Manual. It can also be generated by the PRINT LIBRARY command, as described in the Users Manual, Volume I.

3 DRAWING TAKE-OFF

After the data required for BLAST analysis are collected, they must be condensed and reorganized before they are transferred to BLAST input forms. This condensation/organization step is called Drawing Take-off.

Zone Definition

A major step in the Drawing Take-off process is to define simulation zone boundaries; i.e., to subdivide the building into three-dimensional regions called ZONES in the BLAST language. Ideally, these simulation zones would correspond to the regions in the actual building controlled by individual thermostats, plus attics and/or crawl spaces (if present). In most real buildings, however, such division would result in an unnecessarily large number of simulation zones, causing excessive input preparation labor and computer expense, with little improvement in accuracy. In practice, the actual thermostatic zones are usually aggregated into larger zones. The fundamental rule is that all space within a simulation zone should have uniform air-conditioning needs (i.e., heating or cooling, but not both) at all, or almost all, times. This insures that the simulation will not allow heating demand to offset cooling demand in an unrealistic way. As a matter of good design, actual thermostatic zones in the building should experience more or less uniform external loads. However, larger regions with uniform external loads are often served by several thermostats and capacity modulation devices (e.g., mixing boxes) to allow for nonuniform occupancy and other internal loads. However, since the exact schedules of these occupancies and internal loads are seldom known, several thermostatic areas in such a region can be "lumped together" for simulation purposes.

Simulation zone boundaries must also be defined in a way that guarantees that the physical region inclosed by the zone is served by a single air handler. In this way, the user insures that the BLAST-simulated air systems correspond exactly to the actual systems, thus allowing direct use of name-plate data from these devices. (This is of greater importance in a variable air volume type system, where it is essential that the diversity in the air demand, and hence the fan part-load performance, is properly simulated.)

Zones which are identical or nearly identical need only be input once; their effect is accounted for by using a ZONE MULTIPLIER when describing the fan system serving identical or nearly identical zones.

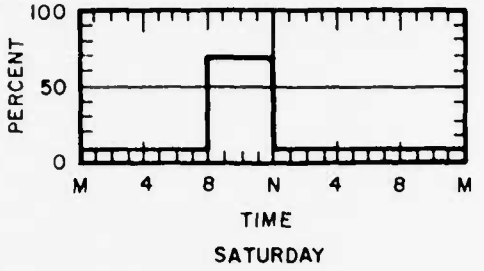
Schedules

After zone boundaries are determined, internal loads and associated schedules must be specified. Although there are standard schedules (24-hour normalized profiles) for lighting, occupancy, equipment, and infiltration available in the BLAST library, specific profiles for the building under study should be used to assure maximum accuracy. Usually, the user defines "aggregate" schedules which apply to all spaces of similar type in the building; each should be given a name for later reference. An example profile is shown in Figure 1; a similar profile should be derived and plotted for each internal load component and for infiltration. A blank profile form is provided in the Appendix. The infiltration profile provides a means of eliminating infiltration when the building is pressurized; infiltration should be set to **0.0** during periods of fan operation and **1.0** when the fan is not operating. The infiltration profile can also be used when infiltration varies with time of day to usage patterns (i.e., building entry ways or lobbies).

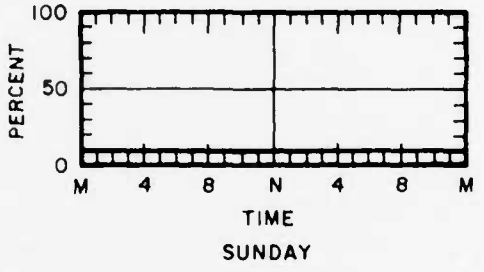
Control Profile

Each type of space in a building also requires a control profile which defines how the thermostat and heating/cooling modulation device operate to maintain space conditions. The user can rely

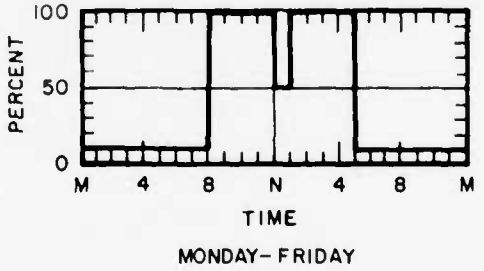
PROFILE APPLIES TO: OFFICE (SPACE TYPE) — PEOPLE, LIGHTS, ELEC. EQUIP (LOAD TYPES)



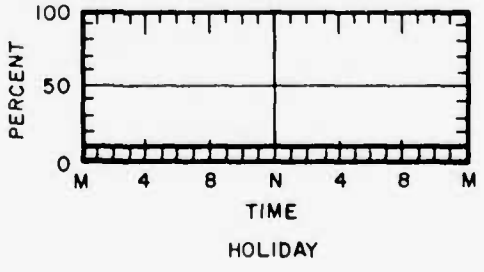
SATURDAY



SUNDAY



MONDAY–FRIDAY



HOLIDAY

Figure 1. Sample profile.

on BLAST library control profiles, or define new profiles specifically applicable to each space type in the building being simulated. A sketch should be drawn of each control profile and it should be given a short, appropriate name. A sample is shown in Figure 2.

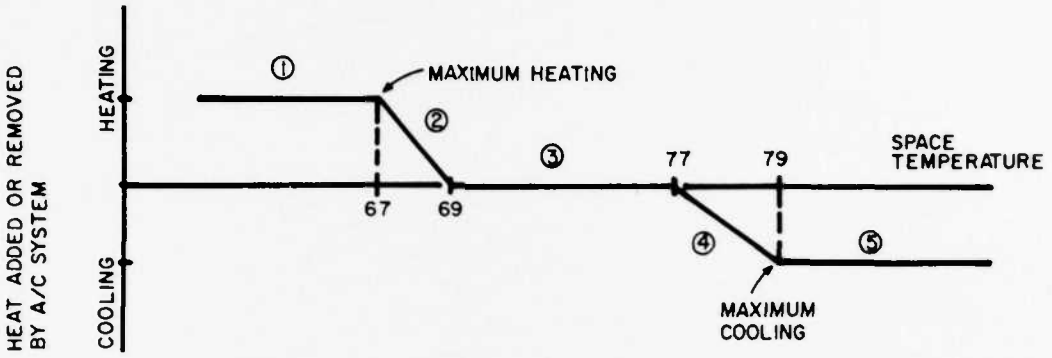


Figure 2. Sample space temperature control profile.

Section Properties

A table should be constructed showing the thickness, density, and thermal properties of each construction element layer (i.e., walls, roofs, floors, etc.) used throughout the building. Convenient, short names should be selected for each construction element not in the library. The BLAST library should be checked to see if construction elements are already in the library. If construction elements *are* listed, the user should record their names in the table.

Geometric Data and Internal Loads

Complete geometric and construction details are required to describe simulation zones on the BLAST input forms. First, data from the drawings are entered onto Geometric Zone Forms (users can reproduce Figure 3 as required). All regularly-shaped zones are easily described using the A, B, and H measurements taken from the drawings. The coordinates of the lower-left corner relative to an arbitrarily selected building origin should also be included. Positions and sizes of windows and doors can be sketched on these forms, and the names previously assigned to construction elements can be written directly on each surface. The internal load data should also be entered. Once a Geometric Zone Form is completed for each simulation zone, BLAST zone description computer input forms can be filled out without further reference to the drawings.

Air System and Plant Data

At a minimum, the description of the building energy distribution system (e.g., fan system) must include the type of fan system, must list the supply air for each zone, and must identify the zones served by each system. Each air system can be described by its schematic, showing air quantities, set-point temperatures, and zones served. Each system description can be done on a single sheet. If the user intends to model specific equipment such as cooling coils or fans, he/she must override BLAST defaults and input data from the manufacturer's literature (see the Users Manual, Volume I, Chapter 5 and Appendix F).

The final step before filling out BLAST input forms is to condense the central plant equipment data. Usually this means collecting name-plate capacity data from the mechanical plans. However, if more exact modeling is desired, the actual design-point and off-design performance data should be obtained from the manufacturer's literature and transformed into the BLAST parameters (see the Users Manual, Volume I, Appendix G).

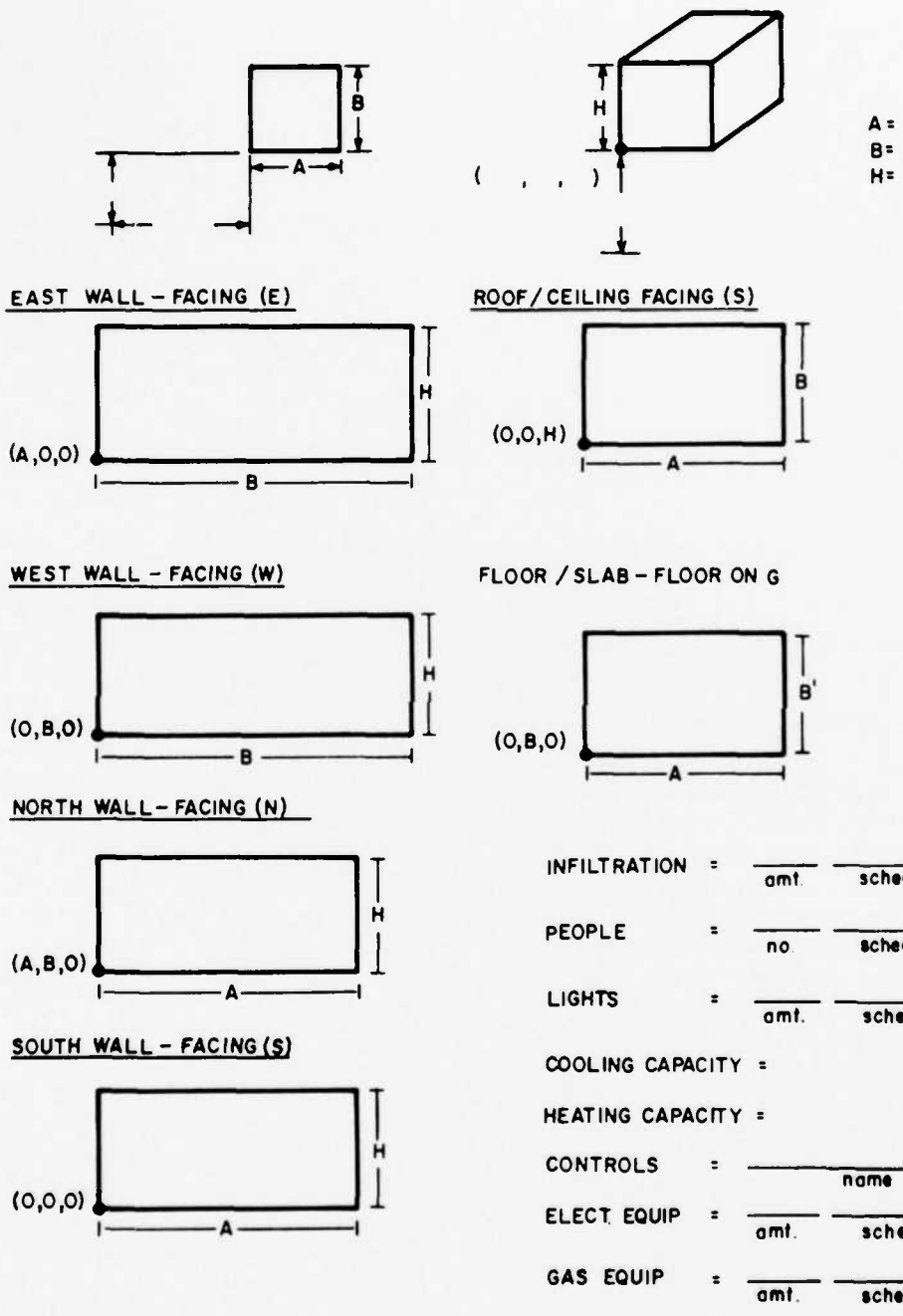


Figure 3. BLAST Geometric Zone Form.

4 USING BLAST INPUT FORMS

After the user has selected the input forms applicable to the building being stimulated, he/she can quickly prepare BLAST input for keypunching. This chapter contains a blank copy of each input form, accompanied by detailed instructions for completing each form. Depending on the complexity of the building, some forms will be used repeatedly to describe a building with several zones; others may not be used at all. Table 1 lists how many of each type of form are required to describe a simple building.

The title of each form will indicate if it is required for the user's particular simulation. Each form is numbered and forms should be input in the sequence indicated by these numbers.

Each form has a number of different card types because BLAST allows the user to omit certain items of input for which default values are acceptable. Some cards may not be required for a particular situation. Also, in some cases, a card may not be required because of the options selected by the user. To clarify which cards are required, each card type is assigned a unique number which is used to reference a brief description of its data items. These descriptions are printed on pages facing the sample forms.

The input forms have a column which indicates whether or not a particular card is required. A "Y" printed in this column indicates the card is *normally required when providing the indicated information*. However, a Y in this column does not mean that the card is always required, since the entire group of statements will often be omitted. Cards without a Y are *always* optional.

The user should use the column marked "PUNCH" to indicate to the keypuncher which cards are to be punched. Note that all data fields on the input forms must be filled in on every card which is actually used in the input deck; while blank spaces are allowed, empty *fields* are *not* allowed. Where there is more than one item per card, the user may be required to supply a value even though the default is acceptable; in such cases, the user should simply write in the default value.

Each card has a space for an optional sequence number. This sequence number will allow a card deck to be automatically sorted if dropped. If used, these numbers should increment by 10 to allow subsequent insertion of new cards (if required).

Table 1
Number of Forms of Each Type Used to Describe a Simple Building

Form	Number	Form	Number	Form	Number
1	1	10A	1 per zone	20	0
2	1	11	1 per fan System	21	0
3	1	12	1 per fan System	22	0
4	2	13	1 per fan System	23	0
5	2	14	0	24	0
6	1	15	1 per fan System	25	1
7	1	16	1	26	1
8	0	17	1	27	1
9	1 per zone	18	0	28	0
10	1 per zone	19	0		

BLAST Input Form 1: RUN CONTROL and Location and Design Day Definitions

Comment Cards

Comment Cards, shown as card type "C" can be used anywhere in the input deck if desired. They do not affect simulation. If used, two asterisks must appear as the first characters on the card.

RUN CONTROL

RC1. First card in BLAST input deck.

RC2. Begins run control sequence.

RC3. Use NEW unless there is an existing zone loads file BLDFL for this project on a computer storage device [Appendix B]*. Use ADD to add the loads for zones in this run (new zone numbers) to an existing BLDFL. Use REPLACE to substitute the results of this run for zones of identical numbers in an existing BLDFL [Appendix B]. If omitted, no zone loads are calculated.

RC4 Use NEW unless there is an existing air system load file AHLDFL for this project on a computer storage device [Appendix B]. Use ADD to add the air system demands (new system numbers) from this run to an existing AHLDFL. Use REPLACE to substitute the system loads from this run for systems of identical numbers in an existing AHLDFL. If omitted, no system loads are calculated.

RC5. Indicates that a central plant simulation is to be run.

RC6. Normally omitted. If present, a complete BLAST library is printed: approximately 80 pages of output are generated.

RC7. Use to specify nonstandard output. If omitted, summary results are printed which are usually sufficient [Chapters 4, 5, 6].

RC8. Use to specify units of input and/or output. If omitted, English assumed [Chapter 3].

Location Definitions

DL1 Used to define locations not already in the BLAST library. DEFINE adds new location definitions to existing library. REPLACE changes definitions of location names already in the library. TEMPORARY will make the location available for this run, but will not alter the library. Note that even if DEFINE or REPLACE is used, the change is not permanent unless the library file NEWLIB is saved after BLAST is executed [Appendix B]. Provide a user-selected name, along with latitude (degrees), longitude (degrees), and time zone number. Usually required, since standard BLAST library does not include locations. See Figure 4 (page 74).

Design Day Definitions

DD1 Begins Design Day definition sequence. Usually required since standard BLAST library does not include design days. May be omitted in subsequent runs if user saves the new library [Appendix B].

DD2.1 Provide a descriptive name, e.g., SEATTLE WINTER, along with HIGH and LOW dry bulb temperatures, °F (or °C), wet bulb temperature, °F (or °C), corresponding to HIGH, and windspeed ft/min (or m/s).

DD2.2 Continuation of DD2.1. Provide direction from which wind is blowing in degrees. North is 0, East 90, etc. Date must be day followed by first three characters of month. PRES is barometric pressure in inches of water (or Pascals). Select CLEARNESS from Figure 4. If DD2.3 is omitted, end with a closing parenthesis and a semicolon. If other Design Days follow, use comma instead of semicolon.

DD2.3 Continuation of DD2.2. Design Day can be caused to use schedules of WEEKDAY (Monday), WEEKEND, or HOLIDAY (Sunday). If Design Day is to be free of rain or snow, no further entry is required. Otherwise, enter a comma followed by RAIN or SNOW. If other Design Days follow, end this card with a comma. Otherwise, close with a semicolon.

DD3 Last card in Design Day definition sequence. Required if DD1 is present.

* [ ] indicates section in Volume I of the Users Manual that should be consulted for further details.

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO.

X	CARD	1–80
	C	`**                        RUN CONTROL BLOCK`
Y	RC1	`BEGIN INPUT;`
Y	RC2	`RUN CONTROL:`
	RC3	`_______ ZONES,`
	RC4	`_______ AIR SYSTEMS,`
	RC5	`CENTRAL PLANT,`
	RC6	`PRINT LIBRARY,`
	RC7	`REPORTS ( ______ ),`
	RC8	`UNITS (IN= ____ , OUT= ____ );`
	C	`**        LIBRARY MODIFICATION BLOCK`
	DL1	`_______ LOCATION: _______ =(LAT= ____ , LONG= ____ , TZ= ____ );`
	DL2	`END;`
Y	DD1	`_______ DESIGN DAYS:`
Y	DD21	`_______ =(HIGH= ____ , LOW= ____ , WB= ____ , WS= ____ ,`
Y	DD22	`DIR= ____ , DATE= ____ , PRES= ____ , CLEARNESS= ____ ,`
Y	DD23	`_______ ),`
Y	DD21	`_______ =(HIGH= ____ , LOW= ____ , WB= ____ , WS= ____ ,`
	DD22	`DIR= ____ , DATE= ____ , PRES= ____ , CLEARNESS= ____ ,`
	DD23	`_______ ),`
	DD21	`_______ =(HIGH= ____ , LOW= ____ , WB= ____ , WS= ____ ,`
	DD22	`DIR= ____ , DATE= ____ , PRES= ____ , CLEARNESS= ____ ,`
	DD23	`_______ ),`
	DD21	`_______ =(HIGH= ____ , LOW= ____ , WB= ____ , WS= ____ ,`
	DD22	`DIR= ____ , DATE= ____ , PRES= ____ , CLEARNESS= ____ ,`
	DD23	`_______ ),`
	DD3	`END DESIGN DAYS;`

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (029/EBCDIC, 026/BCD) 3. CONVENTIONS 1,Ø,S (ALPHA) : " (SPECIAL) 1,0,5 (NUMERIC)

BLAST INPUT FORM 1
Run control

BLAST Input Form 2: Opaque Material Definitions

MD1 — Begins material definition sequence. Use to define layers not already in the BLAST library.

ØM1.1 — Names and defines a layer of opaque material for subsequent use in defining opaque construction elements. If DEFINE is used on MD1 card, the name must not conflict with existing library entries. Provide thickness L, ft (or m), thermal conductivity K, Btu/hr-ft-°F (or W/m-k), specific heat CP, Btu/lb-°F (or kJ/kg-k), density D, lb/ft^3 (or kg/m^3), and absorptivity ABS in the solar spectrum. If next card omitted, close with parenthesis and semicolon [Chapter 3].

ØM1.2 — Continuation of ØM1.1. Use to specify long-wave (thermal) absorptivity TABS and surface roughness. See Table 2 [also Chapter 3].

ØM2 — Use to define air spaces or lightweight layers of materials. If DEFINE is used on MD1, name must not conflict with existing library entries. Provide thermal resistance R, hr-ft^2-°F/Btu (or m^2-k/W) and solar spectrum absorptivity ABS. In the remaining field, enter AIR if an air space [Chapter 3].

ØM3.1, 3.2 — Use to define materials of any kind in free-format. Omit if not needed. See Users Manual [Chapter 3] for options.

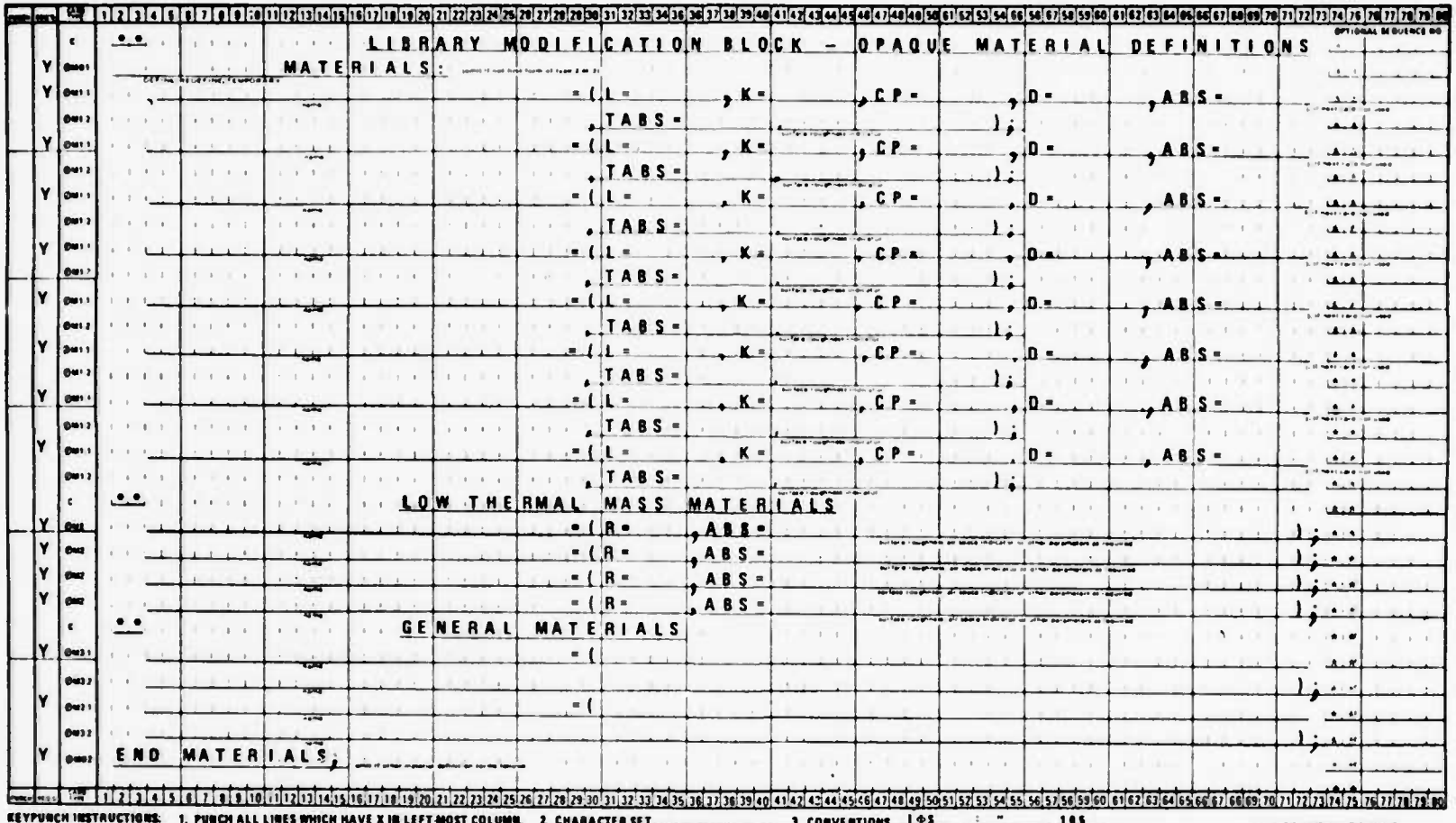
MD2 — Ends all Material Definitions. Omit if any kind of material definitions follow.

Table 2
Surface Roughness

Allowable Entries	Example Surfaces
VERY ROUGH	Stucco, built-up roof with stones, wood shingles
ROUGH	Brick, plaster, concrete block
MEDIUM ROUGH	Concrete, asphalt shingles
MEDIUM SMOOTH	Clear pine
SMOOTH	Smooth plaster, metal
VERY SMOOTH	Glass, painted smooth surface

Note: The default for roughness is ROUGH unless the material is GLASS, in which case the default is VERY SMOOTH.
Roughness is only important for materials forming the outside layer of exterior walls.

ORGANIZATION _____ PROJECT NAME _____ DATE _____ ANALYST _____ PROJECT NO. _____



KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (026/EBCDIC, 026/BCD) 3. CONVENTIONS 1,0,$ (ALPHA) : " (SPECIAL) 1,0,$ (NUMERIC)

BLAST INPUT FORM 2

Definition of opaque materials

BLAST Input Form 3: Glass and Shade Material Definitions

General

MD1 Begins materials definition sequence. Do not use if materials definitions continue from Input Form 2.

GD1.1 Names and defines a transparent material layer for subsequent use in defining WINDOWS. If DEFINE is used on MD1 card, name must not conflict with existing library entries. Provide thermal resistance R, hr-sq ft-°F/Btu (or m^2-k/W) and other solar transmittance TRANS. End the definition with parenthesis and semicolon if default index of refraction is acceptable and there is no reflective film [Chapter 3].

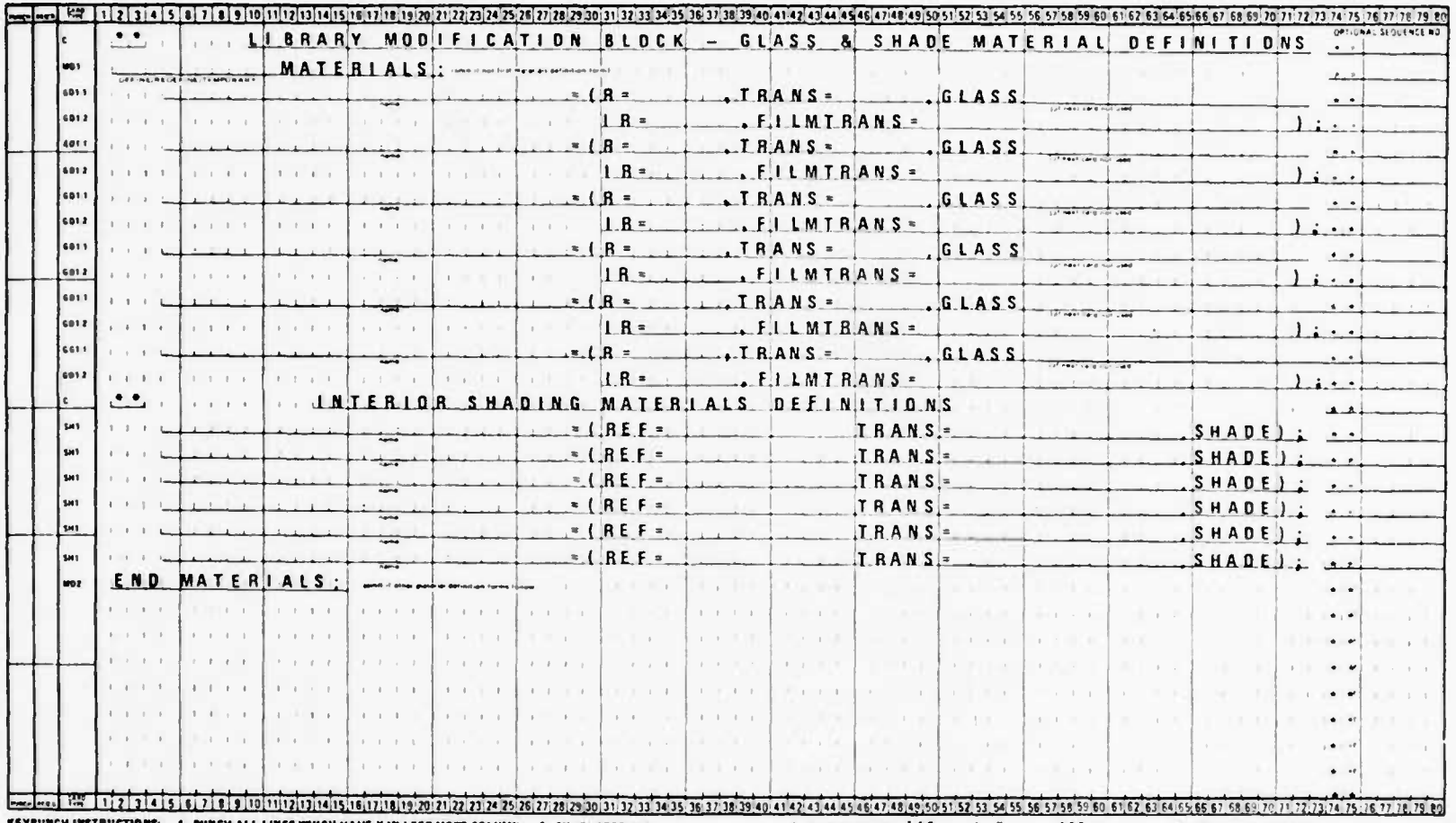
GD1.2 Continuation of GD1.1. Use this card to provide index of refraction and the overall solar transmittance of glass plus film or coating FILMTRANS if such film or coating is used. This card is omitted for standard glass [Chapter 3].

Interior Shade Material Definition Card Types

SH1 Names and defines a layer of interior shading material for subsequent use in defining WINDOWS. Cannot be used except as the innermost layer in a WINDOW definition. If DEFINE is used on MD1 card, name must not conflict with existing library entries. Provide solar reflectance REF, and solar transmissivity TRANS [Chapter 3].

MD2 Ends all material definitions. Omit if any kind of materials definitions follow.

ORGANIZATION _____ PROJECT NAME _____ DATE _____ ANALYST _____ PROJECT NO. _____



KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (029/EBCDIC,026/BCD) 3. CONVENTIONS 1,4,5 (ALPHA) : = (SPECIAL) 1,0,5 (NUMERIC)

BLAST INPUT FORM 3

Definition of material to be used in windows and interior shading

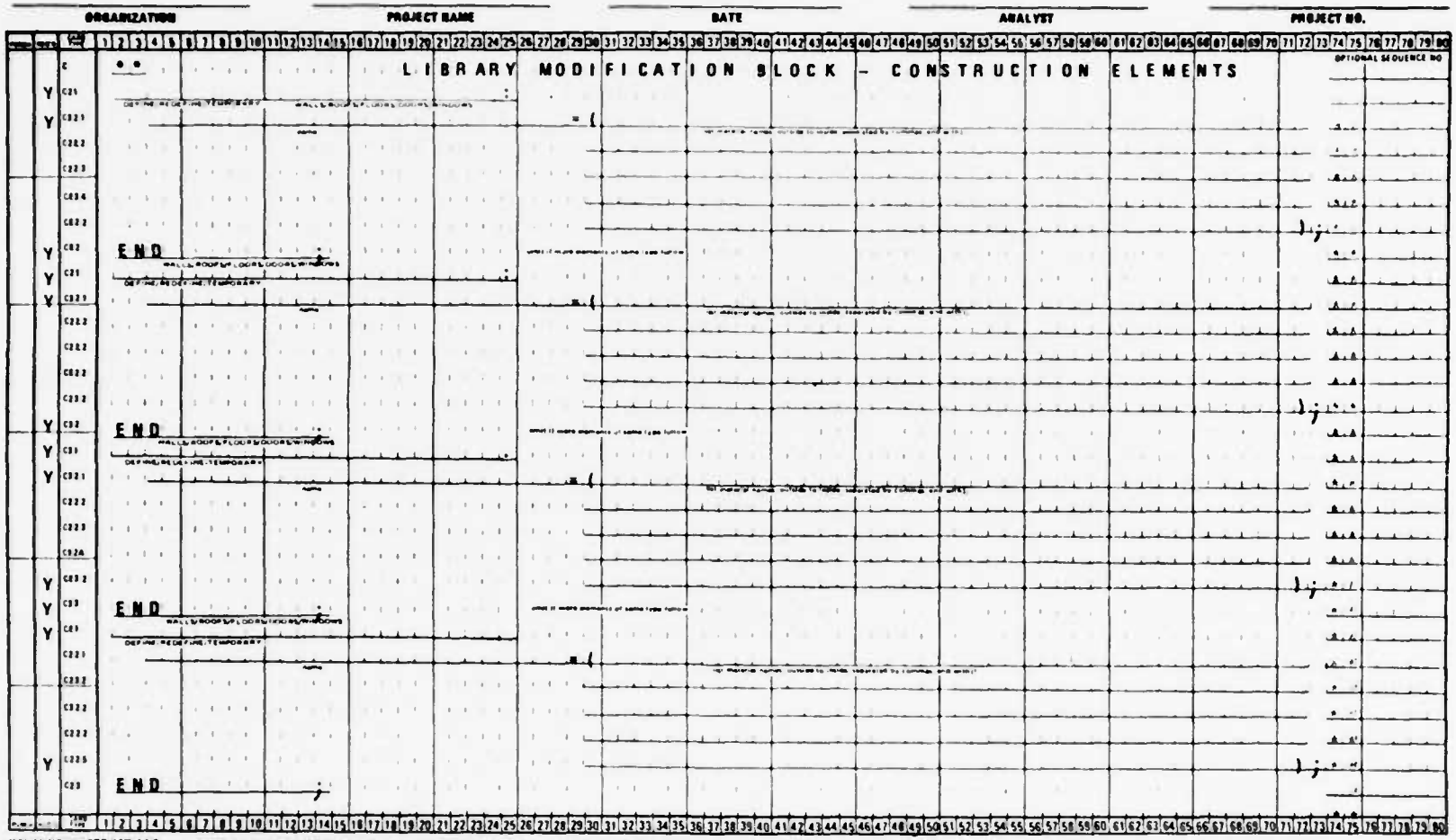
Input Form 4: Construction Element Definitions Card Types

CE1 Begins definition sequence for WALLS, FLOORS, ROOFS, DOORS, or WINDOWS. One card of this type allows definition of all construction elements of the type indicated in the second space. DEFINE adds new construction elements to existing library. REPLACE changes definitions of elements already there. TEMPORARY will make the elements available for this run, but will not alter the library. Note that even if DEFINE or REPLACE is used, the change is not permanent unless the library file NEWLIB is saved after BLAST is executed [Appendix B].

CE2.1 Names and defines a construction element of the type indicated in the preceding CE1 type card. If DEFINE is used on CE1, name must not conflict with existing library entries of this type. Provide list of names of material layers, from outermost to innermost. Use commas to separate names. Names of material layers must be selected from the library, or be previously defined in this run. Close the list with a parenthesis and semicolon. No more than 10 layers are allowed [Chapter 3].

CE2.2-5 Continuation of CE2.1. Use as required to complete the definition of the construction element.

CE3 Ends the sequence for a particular type of construction element definition. Insert same type (WALL, FLOOR, etc.) as in the preceding CE1 card. Omit if other construction elements of this type are required.



KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (026/EBCDIC, 026/BCD) 3. CONVENTIONS 1,0,S (ALPHA) : " (SPECIAL) 1,0,5 (NUMERIC)

BLAST INPUT FORM 4

Definition of construction elements – walls, roofs, floors, doors and windows

Input Form 5: Schedule Definitions

SC1 Begins definition sequence for normalized SCHEDULES, subsequently used to modify internal loads and infiltration in zone definitions. DEFINE adds new schedules to those in the existing library. REPLACE changes definitions of schedules already present. TEMPORARY makes the schedule defined on this form available only for this run. Note that even if DEFINE or REPLACE is used, the change is not permanent unless the library file NEWLIB is saved after BLAST execution [Appendix B]. Provide name which does not conflict with existing library if DEFINE is used [Chapter 3].

SC2.1 Defines daily profile for SATURDAY. Begin with a parenthesis, and provide a number between 0 and 1.0 for each of 24 hours. Separate numbers with a comma and end the sequence with a parenthesis followed by a comma. Alternately, a sequence of the form 8 TO 17=0.9 can be used to set a group of hours to the same value. In this example, the value 0.9 is assigned to the interval *between* 8-am and 5 pm.

SC2.2 Continuation of SC2.1. Use if required for long schedules.

SC3.1 Defines daily profile for SUNDAY. The profile can be defined exactly as described for SC2.1. If SATURDAY has already been defined and is identical to the SUNDAY profile, SATURDAY can be entered without parentheses after the equal sign. End with a comma in this case, since SC3.2 will not be required.

SC3.2 Continuation of SC3.1. Use if required for long schedules.

SC4.1 Defines daily profile for weekdays. The profile can be defined exactly as described for SC2.1. Alternately, equate to a previously defined day; i.e., enter SATURDAY or SUNDAY after the equal sign. No parentheses are used in this case, and a comma should be placed after the entry. If all weekdays are not the same, General Card (Input Form 28) can be used to separately define each day following the same rules [Chapter 3].

SC4.2 Continuation of SC4.1. Use if required to define long schedules.

SC5.1 Defines daily profile for holidays. The profile can be defined exactly as described for SC2.1. Alternately, can be equated to an already defined day as described in SC4.1. Since this is the last day-type for this schedule, end card with a semicolon if next card is not needed.

SC5.2 Continuation of SC5.1. Use if required to define long schedules.

SC6 Ends definition of the schedule begun with the preceding SC1 card.

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO.

X	Card	Columns 1–80
	C	** LIBRARY MODIFICATION BLOCK – SCHEDULE DEFINITIONS
Y	SC1	SCHEDULE = ( ) ;
Y	SC21	SATURDAY =
	SC22	
Y	SC31	SUNDAY = ;
	SC32	;
Y	SC41	MONDAY THRU FRIDAY =
	SC42	;
Y	SC51	HOLIDAY =
	SC52	;
Y	SC6	END SCHEDULE;
Y	SC1	SCHEDULE = ( ) ;
Y	SC21	SATURDAY =
	SC22	
Y	SC31	SUNDAY = ;
	SC32	;
Y	SC41	MONDAY THRU FRIDAY =
	SC42	;
Y	SC51	HOLIDAY =
	SC52	;
Y	SC6	END SCHEDULE;

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT MOST COLUMN. 2. CHARACTER SET (029/EBCDIC,026/BCD) 3. CONVENTIONS I,Ø,S (ALPHA) : " (SPECIAL) 1,0,5 (NUMERIC)

BLAST INPUT FORM 5

Definition of internal load schedules

Input Form 6: Controls Definitions

CL1 Begins definition sequence for zone temperature controls, as shown in Figure 5. DEFINE adds new controls to existing library. REPLACE changes definitions of controls already present. TEMPORARY makes the controls defined on this form available only for this run. Note that even if DEFINE or REPLACE is used, the change is not permanent unless the library file NEWLIB is saved after BLAST execution [Appendix B]. Provide name which does not conflict with existing controls in library if DEFINE is used [Chapter 3].

CL2 Begins profile definition sequence.

CL3 Use to define a control profile, which is a single, continuous broken-line curve representing heating/cooling capacity vs zone air temperature. One profile must be defined for each distinct type of control strategy to be used during the week (i.e., occupied period, setback period, warmup period etc.). Card types CL5-8 indicate when during each day each control strategy applies. The profile is defined by two or more "break-points," indicating normalized capacity and temperature. Positive capacity indicates heating and negative indicates cooling. Maximum heating and cooling capacities are at +1 and −1, respectively. For example, the profile of Figure 2 is indicated by (1.0 AT 67, 0.0 AT 69, 0.0 AT 77, −1.0 AT 79). Replace the comma on the form with a semicolon on the last profile given. Note that profiles *do not* carry over to subsequent control definitions. Profile names *must* be *one* word of 10 characters or less.

CL4 Begins control schedules.

CL5 Indicates which profiles are to be applied on SATURDAY and when. The times (in integer hours) at which each profile begins to be used and ceases to be used must be entered. The profile names must be selected from among those defined on the preceding CL3 cards. The CL5 card type allows two profiles per day; if more are required use General Input Form 28.

CL6 Indicates which profiles are to be applied on SUNDAY, and when, as in CL5. Alternately, SATURDAY can be inserted after the equal sign, without parentheses, to equate SUNDAY to SATURDAY.

CL7 Indicates which profiles are to be applied on weekdays and when, as in CL6. If all weekdays are not alike, General Input Form 28 can be used.

CL8 Indicates which profiles are to be applied on holidays and when, as in CL6.

CL9 Use to define seasonal availability of heating. Dates are one or two digit integers followed by a three-character abbreviation for the month (i.e., HEATING ON FROM 30 SEP THRU 1 MAY;)

CL10 Same as CL9 but for cooling.

CL11 Ends controls definition sequence begun by preceding CL1 card.

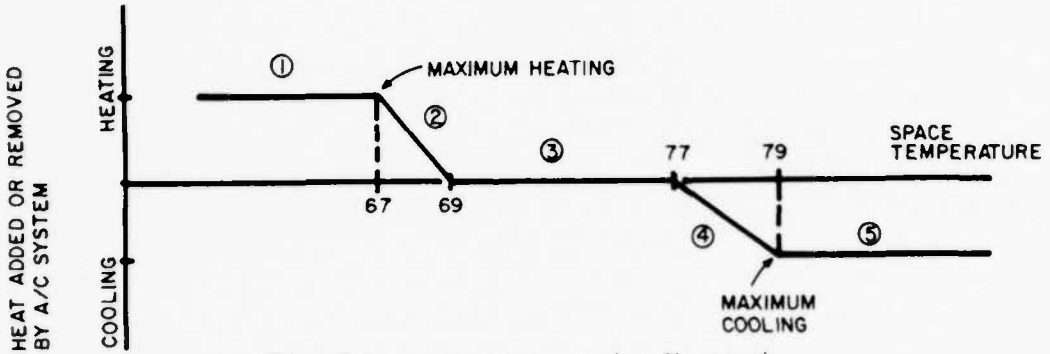
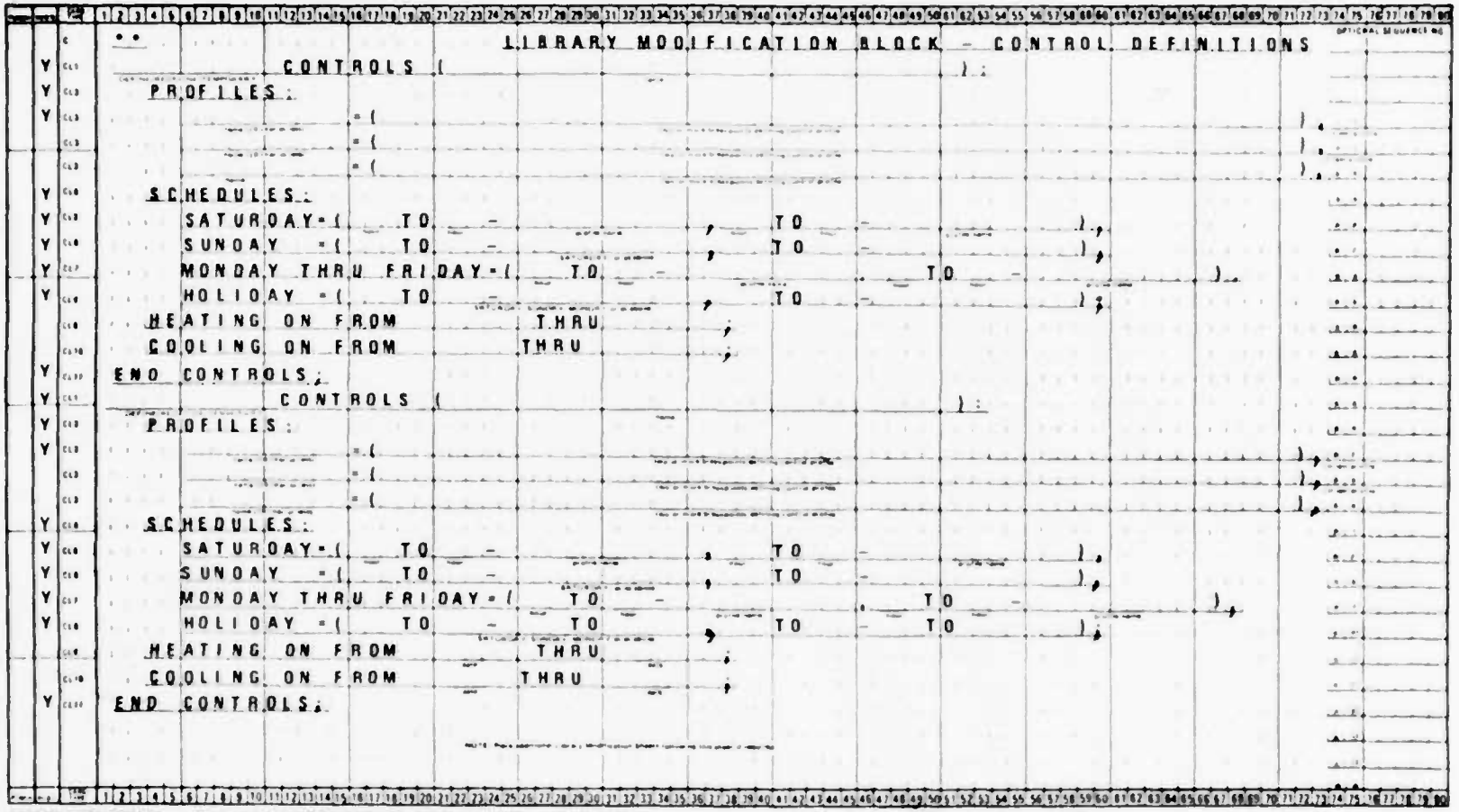


Figure 5. Space temperature control profile example.

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO.



KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN 2. CHARACTER SET (026/EBCDIC 026/BCD) 3. CONVENTIONS 1,0,5 (ALPHA) - (SPECIAL) 1,0,5 (NUMERIC)

BLAST INPUT FORM 6

Definition of zone temperature controls

Input Form 7: Project and Building Description

Project Description

PD1.1 Provide suitable title. If PD1.2 not used, end with quotation mark and semicolon.

PD1.2 Continuation of PD1.1. Use to provide other information such as organization and analyst.

PD2 Provide location name. If name is not in permanent library (usually, it is not), it must be defined for this run (see Input Form 1).

PD3.1 Provide names of Design Days. If names are not in permanent library (usually, they are not) they must be defined for this run (see Input Form 1). If simulation for Design Days is not required, omit this card and the next.

PD3.2 Continuation of PD3.1. Use to indicate more Design Days to be run. Omit if not required.

PD4. If this card is used, the attached weather tape [Appendix B] will be used for weather data, and simulation will be done for the period beginning and ending on indicated dates. Can be used in same run as DESIGN DAYS. If a weather tape is used, location data will be taken from the weather tape, *not* the PD2 card.

PD5.1 Ground temperatures may be provided with this card. Estimate 12 values in °F (or °C) using data in Appendix E of Users Manual.

PD5.2 Continuation of PD5.1.

Building Definition

BD1 Begins Building Definition sequence. Required if zone loads are to be calculated.

BD2 Provide a name for the building, if desired. End with quotation and semicolon.

BD3 Use this card to assign numerical values to convenient variable names. These variable names can then be used in place of numbers throughout the building description, i.e., in any zone. Ceiling to floor height, or building module dimension are commonly assigned *here, and* N = 0, E = 90, S = 180, *and* W = 270 are defined.

BD4 Enter the angle from true north to the arbitrarily defined building north axis. Clockwise angles are positive (see Figure 6). If this statement is used, all subsequent zone north axis will be relative to the *building north*.

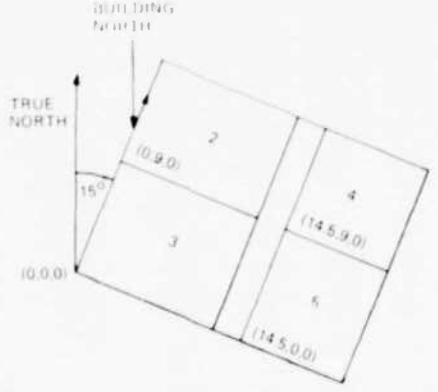
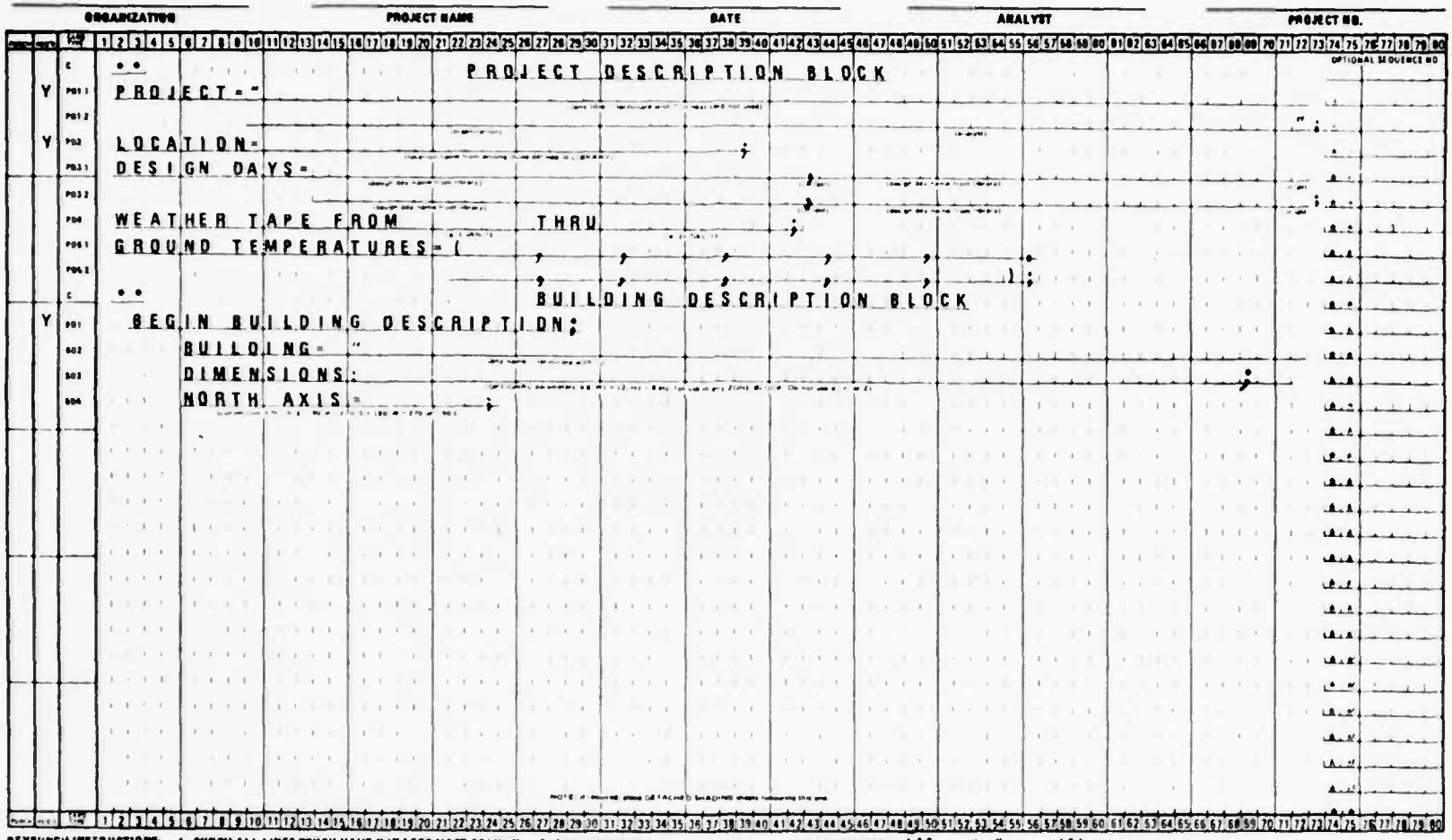


Figure 6. Convention for NORTH AXIS.



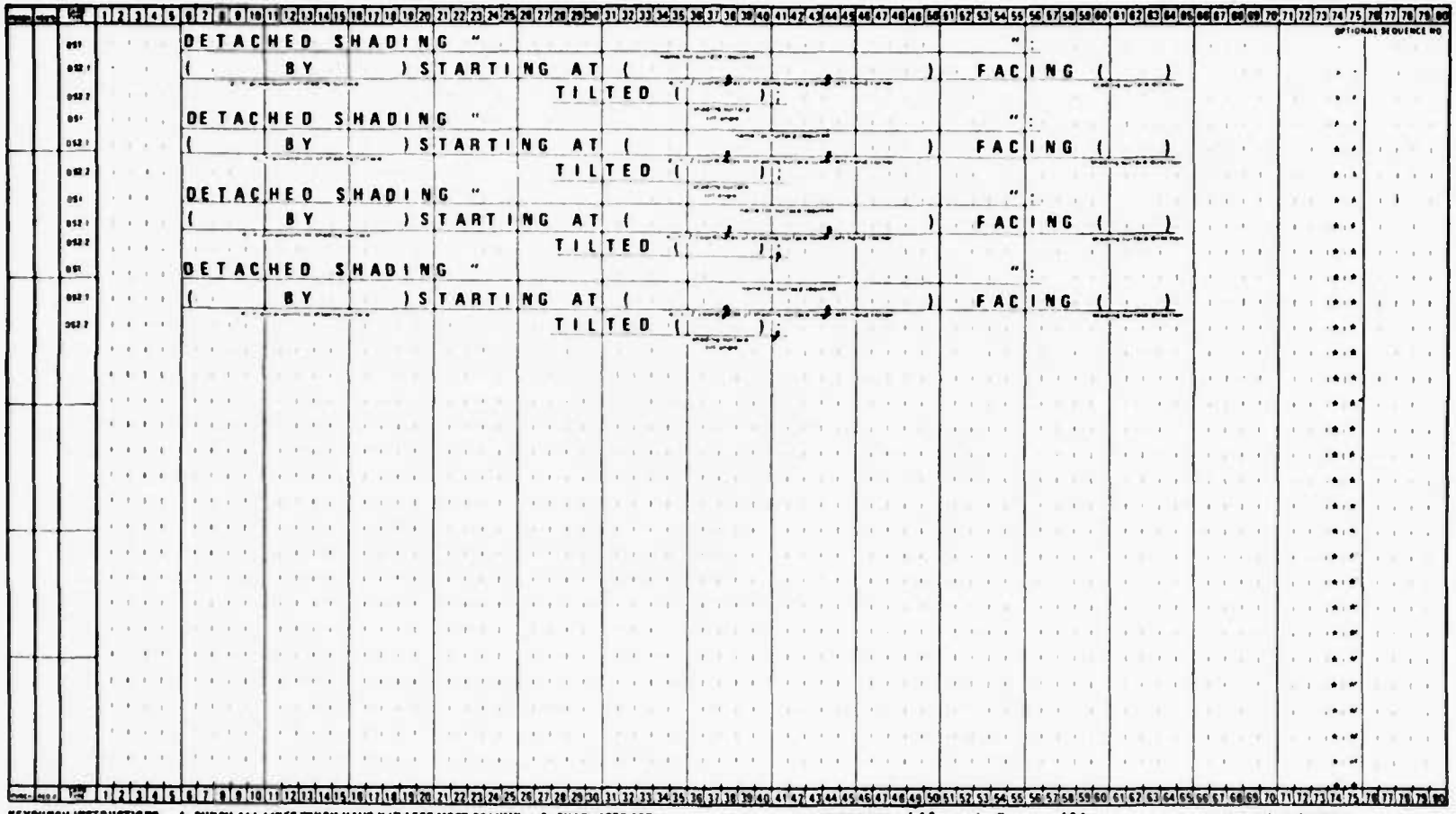
Project description and beginning of building description

Input Form 8: Detached Shading Card Types

DS1 Begins the definition of a "detached shader" and names it. Use detached shaders to describe any solid objects which cast a shadow on more than one building zone, e.g., an adjacent building or tree, or a wing of the building [Advanced Topics, Chapter 4].

DS2 Provide width and height in feet (or m) of the shader, and the coordinates of its lower-left hand corner, as viewed from its FACING direction, relative to the *building* origin. Also give facing direction (with building NORTH AXIS as 0) and its tilt in degrees from the horizontal.

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO.



KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (026/EBCDIC, 026/BCD) 3. CONVENTIONS 1,¢,$ (ALPHA) : - (SPECIAL) 1,0,5 (NUMERIC)

BLAST INPUT FORM 8

Description of detached shading surfaces

Input Form 9: Zone Description

ZD1 Use to number and name a ZONE, ATTIC, or CRAWL SPACE. Zone number can be any six-digit or less number. It does not have to be in sequence with other zones.

ZD2 Use this card to assign numerical values to convenient variable names *to be used only in describing this zone*. The scheme suggested in the BLAST Geometric Zone Form (Figure 3) requires that dimensions A, B, and H be defined here, although any variable names may be used.

ZD3 Use this card to position the lower-left corner of the zone (viewed from the top) in the building coordinate system. If omitted, the zone is placed at the building origin, which may be inappropriate if detached shading is being simulated.

ZD4 Use this card if zone north (Y-axis) is not aligned with building *north. If used, the angle represents the angle from the building* north to the zone north, with clockwise angles being positive.

ZD5.1 Insert the name of a control profile defined in this run on Form 6 or in the permanent library. This will define how the zone temperature varies with the load, imposing limitations of air system capacity and thermostat characteristics. End with semicolon if next card omitted.

ZD5.2 Use to specify maximum capacity of air system serving the zone. If omitted, 3,412,000 kBtu/hr (1 000 000 kW) is assumed.

ZD6.1 Indicate maximum number of people in the zone, and the name of the normalized SCHEDULE which represents variation in this number with time and day. The schedule name must be in the permanent library, or defined on Input Form 5. End with semicolon if next card is omitted.

ZD6.2 Use this card to override default thermal load per person and the radiant percent. ACTIVITY LEVEL kBtu/hr (or kW) is the total heat given off per person. The default is .45 kBtu/hr (.13 kW). BLAST adjusts sensible and latent fractions with zone air temperature. The specified PERCENT RADIANT is deposited at solid surfaces for delayed entry into zone air. Its default is 70 percent. Use percents, *not* fractions.

ZD7.1 Indicate the maximum power for lights kBtu/hr (or kW) in the zone, and the name of the normalized SCHEDULE which represents variation of this number with time and day. This power affects both base electrical load and thermal load on the zone. The schedule name must be in the permanent library, or defined on Input Form 5. End with semicolon if next card is omitted.

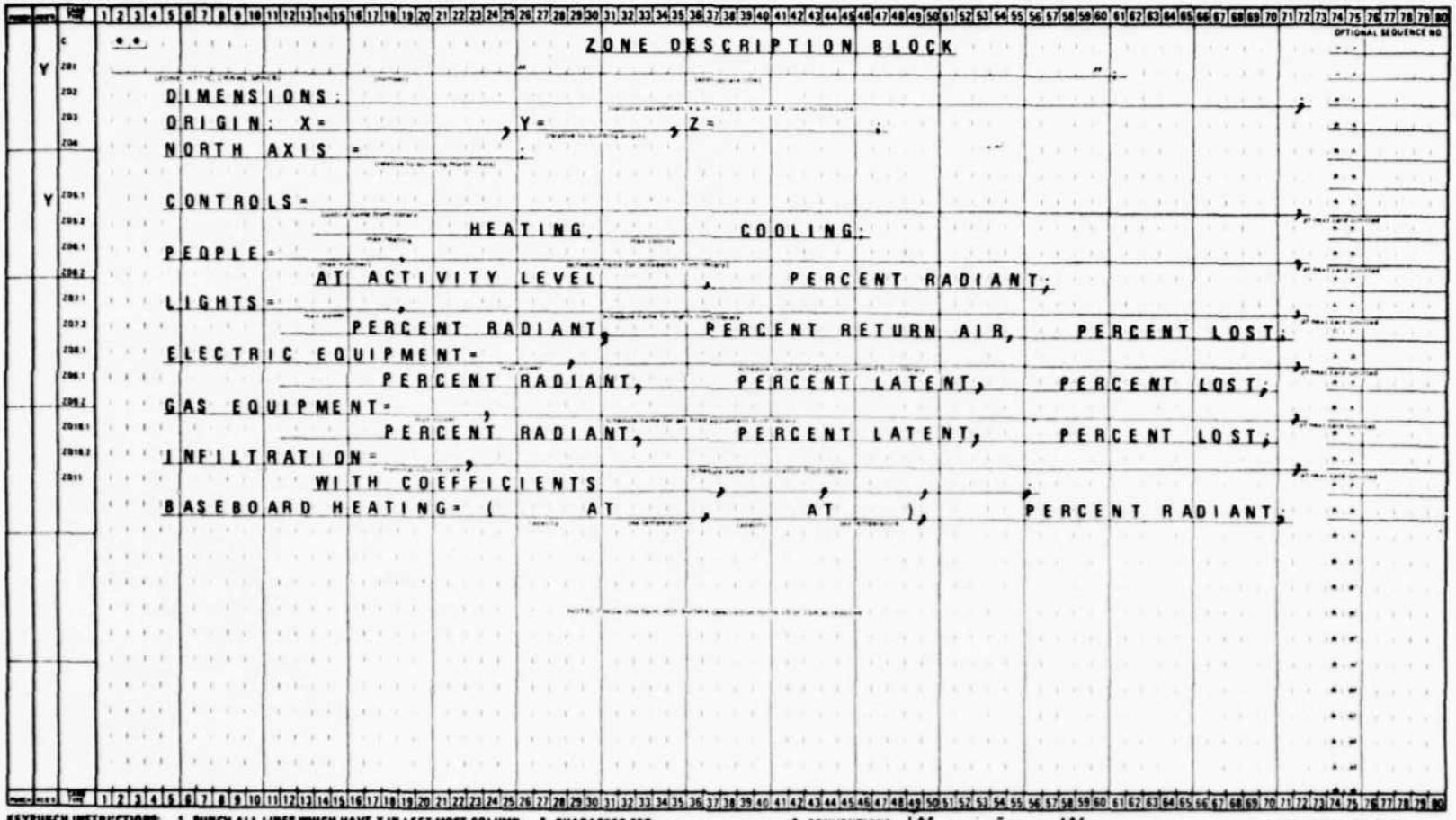
ZD7.2 Use this card to override default values of lighting PERCENT RADIANT (50 percent), PERCENT RETURN AIR (0 percent); i.e., light energy which is added directly to the return air stream without becoming part of the room load, and the PERCENT LOST (default is 0 percent) from the zone. PERCENT LOST becomes part of the base electrical load but does not affect the zone load or *return air heat gain*. Use percents, *not* fractions.

ZD8.1 Indicate the maximum power for electrical equipment within the zone in kBtu/hr (or kW), and the name of the normalized schedule which represents variation of this number with time and day. This power affects both base electrical load and thermal load on the zone. The default is 0. The schedule name must be in the permanent library, or defined on Input Form 5. End with semicolon if the next card is omitted.

ZD8.2 Use this card to override default values of electrical equipment PERCENT RADIANT (default is 10 percent), PERCENT LATENT (default is 0 percent), and PERCENT LOST (default is 0 percent) from the zone. Use percents, *not* fractions.

ZD9.1 Indicate the maximum power for gas-fired equipment within the zone in kBtu/hr (or kW) and the name of the normalized schedule which represents variation of this number with time and day. This power affects both base gas load and thermal loads on the zone. The schedule name must be in the permanent library, or defined on Input Form 5. End with semicolon if next card is omitted.

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO.



KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (029/EBCDIC, 026/BCD) 3. CONVENTIONS 1,0,5 (ALPHA) - (SPECIAL) 1,0,5 (NUMERIC)

BLAST INPUT FORM 9

Description of simulation zones

Input Form 9 (cont'd)

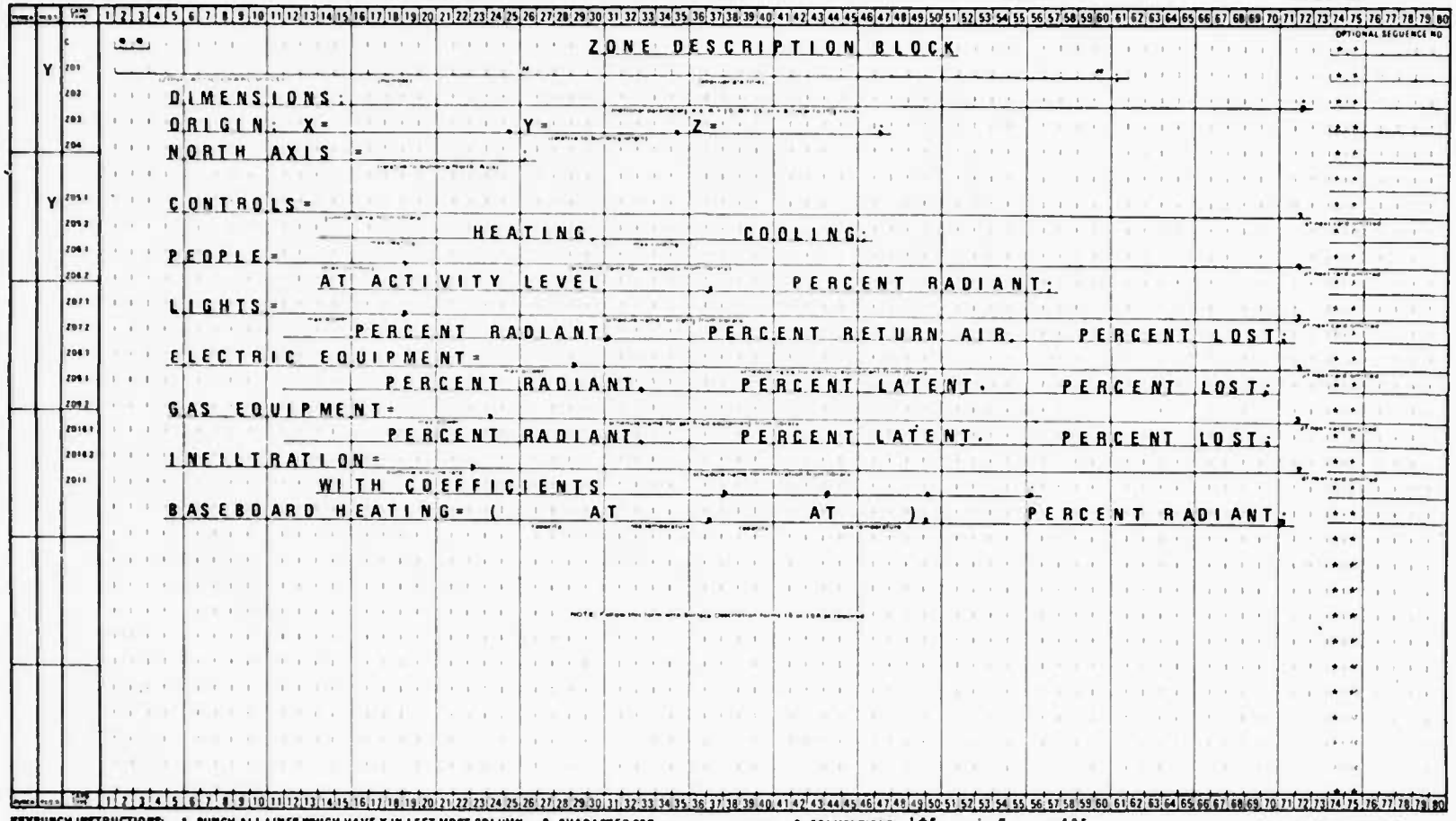
ZD9.2 Use this card to override default values of gas equipment PERCENT RADIANT, PERCENT LATENT, and PERCENT LOST from the zone. Use percents, *not* fractions. Defaults are the same as for electric equipment.

ZD10.1 The amount of infiltration in ft^3/min (or m^3/sec) into the zone from cracks, door openings, etc., under normal temperature and wind conditions should be entered here. BLAST will adjust as conditions vary. The adjusted value is then multiplied by the normalized SCHEDULE; the schedule is usually used to "turn off" the infiltration when fans are keeping the building pressurized or to schedule infiltration in entryways or other areas where usage (i.e., number of times doors are opened) affects infiltration.

ZD10.2 Use this card to override default coefficients in the infiltration vs windspeed and temperature equation [Advanced Topics, Chapter 4].

ZD11 Indicate the outside air-controlled baseboard heating capacity in kBtu/hr (or kW) at two outside air temperatures, °F (or C), and the PERCENT RADIANT. Capacity is varied linearly and the radiant part deposited on room solid surfaces for delayed entry into the zone air. Note that zone temperature controlled baseboard heaters can be specified on Input Form 11 and should not be specified here.

ORGANIZATION _____ PROJECT NAME _____ DATE _____ ANALYST _____ PROJECT NO. _____



KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (026/EBCDIC,026/BCD) 3. CONVENTIONS 1,0,$ (ALPHA) : (SPECIAL) - 1,0,5 (NUMERIC)

BLAST INPUT FORM 9

Description of simulation zones

Input Form 10: Surface Description Without Subsurfaces

SD1 Select the surface type from Table 3. Group surface types together. Additional SD1 cards are provided on form so that several different surface types can be coded on a single sheet; when several surfaces of the same type are required, the intervening SD1 cards should be omitted. Nonrectangular surfaces can be described on General Input Form 28 [Advanced Topics, Chapter 4].

SD2 Provide the coordinates X, Y, Z in ft (or m) of the lower-left corner of the surface (viewed from the outside) measured from the *zone* origin. Provide the FACING direction of the outside of the surface, relative to the *zone* north. If nonstandard tilt is required (see Table 3) insert TILTED= followed by the angle from the horizontal. See the Geometric Zone Form (Figure 3) for conventions.

SD3 Provide the name of the construction element forming the surface, and the width and height of the surface in ft (or m). Width is measured from its lower-left corner to its lower-right corner; height is the other dimension. (See the Geometric Zone Form, Figure 3, for conventions.) Name must be from those in the permanent library or defined on Input Form 4, and applicable to the surface type indicated on SD1 (see Table 3).

ZD13 Ends description of zone begun with preceding ZD1. Omit if any further description of this zone follows, such as Forms 10 or 10A.

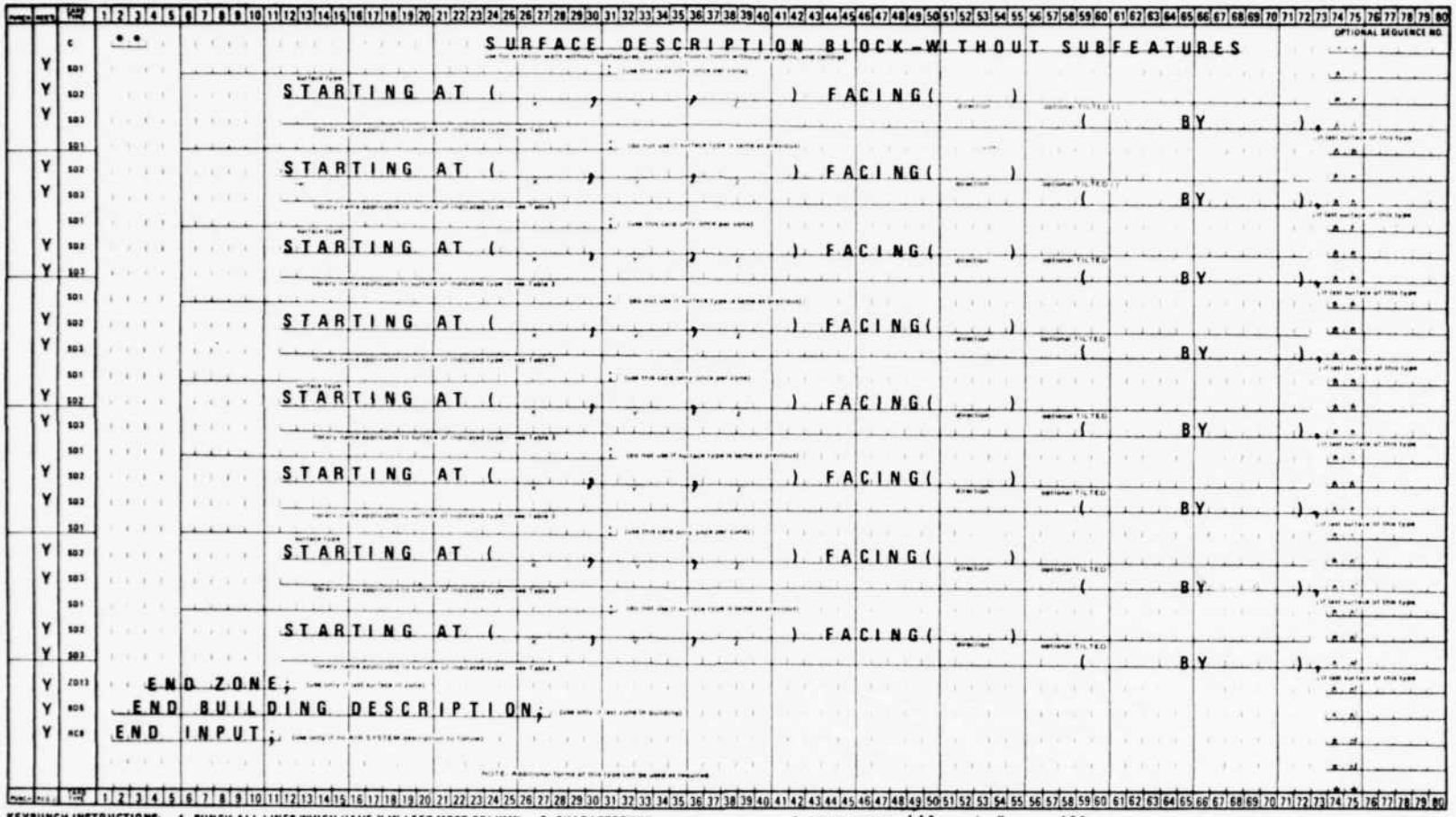
BD5 Ends building description begun with preceding BD1. Use only after all zones have been described.

RC9 Last card in BLAST input deck. Omit if input of any kind follows.

Table 3
Allowable BLAST Surface Types

	Default Tilt
EXTERIOR WALLS	90
WALLS TO UNCOOLED SPACES	90
EXPOSED FLOORS	180
ROOFS	0
PARTITIONS	90
CEILINGS	0
FLOORS	180
BASEMENT WALLS	90
SLAB ON GRADE FLOOR	180
ATTIC FLOOR	180
CRAWL SPACE CEILING	0
CEILING UNDER ATTIC	0
FLOOR OVER CRAWL SPACE	180

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO.



KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (026/EBCDIC,026/BCD) 3. CONVENTIONS I,Φ,S (ALPHA) : " (SPECIAL) I,0,S (NUMERIC)

BLAST INPUT FORM 10

Definition of surfaces enclosing the zone

Input Form 10A: Surface Description With Subsurfaces

SD1 Indicate the surface type from among those in Table 3. Group surfaces so that all surfaces of this type are together. Additional SD1 cards are provided so that several different surface types can be coded on a single sheet; when several surfaces of the same type are required, the intervening SD1 cards should be omitted. Note that nonrectangular surfaces can be described on General Input Form 28 [Advanced Topics, Chapter 4].

SD2 Provide the coordinates X, Y, Z in ft (or m) of the lower-left corner of the surface, viewed from the outside and measured from the *zone* origin. Provide the FACING direction of the outside of the surface, relative to the *zone* north. If nonstandard tilt is required (See Table 3) insert TILTED= followed by the angle from the horizontal. See Geometric Zone Form (Figure 3) for helpful conventions.

SD3 Provide the name of the construction element forming the surface, and the width and height of the surface in ft (or m). Width is measured from its lower-left corner to its lower-right corner, while height is the other dimension. See Geometric Zone Form (Figure 3) for helpful conventions. Name must be from those in the permanent library or defined on Input Form 4, and applicable to the surface type indicated on SD1. (See Table 3.)

SD4 Use to begin definition of a subfeature such as windows. Allowable entries are WINDOWS OF TYPE usname1, DOORS OF TYPE usname2, OVERHANG or WINGS. Here usname1 or usname2 must be from the permanent library or defined on Input Form 4, and of the appropriate type. Note that no punctuation is required or allowed here.

SD5 Indicate the width and height in ft (or m) of the subfeature and the location of its lower-left corner relative to that of the surface itself. [See Chapter 4 for convention on WINGS and OVERHANGS.] WINDOWS may be given a set-back by placing REVEAL (usn1) in the field following the coordinates, where usn1 is the setback in ft (or m). If the next card is omitted, end SD5 with a comma if there are no further subfeatures for the current surface. End SD5 with a semicolon if it concludes all *surfaces of the current type.*

SD6 This card can be used to position another subfeature like the one(s) described on the preceding SD4 and SD5 cards elsewhere on the surface. Enter its coordinates in ft (or m) and REVEAL (usn1), if needed (see card SD5). If the next card is omitted, end SD6 with a comma if there are no further subfeatures for the current surface. End SD6 with a semicolon if it concludes all *surfaces of the current type.*

SD7 Use this card to express nonstandard conditions on the outside of the surface being described. By inserting appropriate coefficients, the outside surface temperature can be made to vary with inside and outside dry bulb air temperature, ground temperature, and windspeed [see Advanced Topics, Chapter 4].

ZD13 Ends description of zone begun with preceding ZD1. Omit if any further description of this zone follows, such as Input Forms 10 or 10A.

BD5 Ends building description begun with preceding BD1. Use only after all zones have been described.

RC9 Last card in BLAST input deck. Omit if input of any kind follows.

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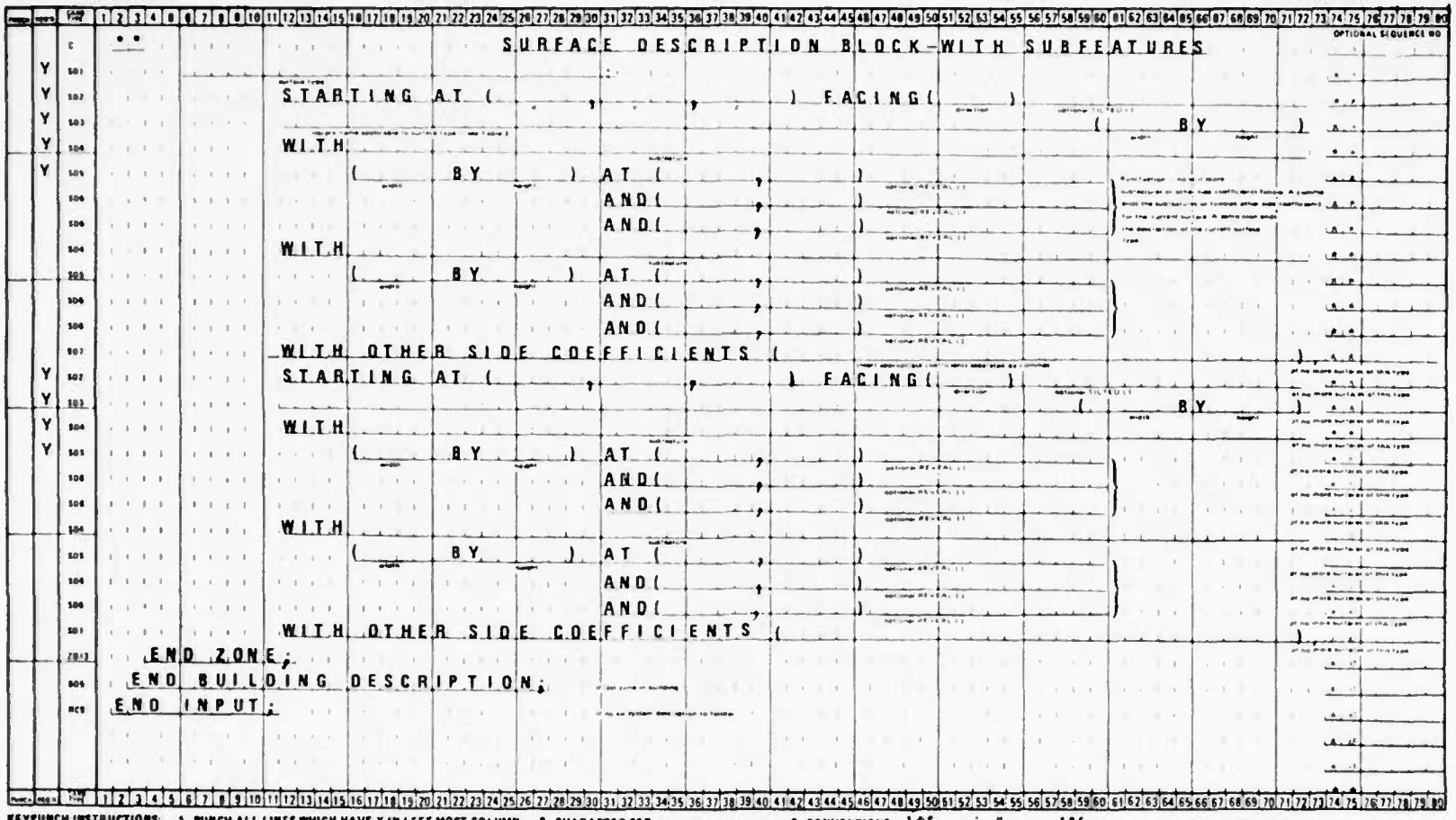


KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT MOST COLUMN. 2. CHARACTER SET (029/EBCDIC, 026/BCD) 3. CONVENTIONS 1,0,5 (ALPHA) : ~ (SPECIAL) 1,0,5 (NUMERIC)

BLAST INPUT FORM 10A

Definition of exterior walls with windows or attached shading, roofs with skylights, or surfaces with special other side conditions

Input Form 11: Fan System Description

FS1 Begins description of air distribution systems.

FS2 Select one system type from Table 4. Provide a unique number, six digits or less, and a name for the fan system to be described.

FS3.1 Continue fan system name, if required, and list the numbers of the zones served by this system. Use next card, if necessary, or close with semicolon.

FS3.2 Continuation of FS3.1. Use for listing more zone numbers or omit.

FS4 This card begins a list of parameters which describe the capacity and other characteristics of the branch of the fan system serving the indicated zone. Indicate the maximum supply air volume in ft^3/m (or m^3/s).

FS5 Use this card to indicate the minimum fraction (*not* percent) for the VAV box serving the zone. Omit for constant volume system.

FS6 Use this card to specify air volume exhausted directly from the zone, e.g., toilet or kitchen exhaust fans. Does *not* refer to ventilation air relief at the air handler.

FS7 Use this card to indicate presence of reheat coil or baseboard heater and capacity in kBtu/hr (or kW). Reheat or baseboard heating is controlled by room thermostat to balance the room heating demand and/or offset over-cooling. Omit if neither is used.

FS8 REHEAT or BASEBOARD HEAT ENERGY SUPPLY. Default is HOT WATER. Omit if FS7 is not used.

FS9 Use this card to indicate that this zone is identical to several others in the building. The load reflected at the serving fan system and the base loads will be multiplied by ZONE MULTIPLIER.

FS10 Ends the list of parameters begun by preceding FS4 card.

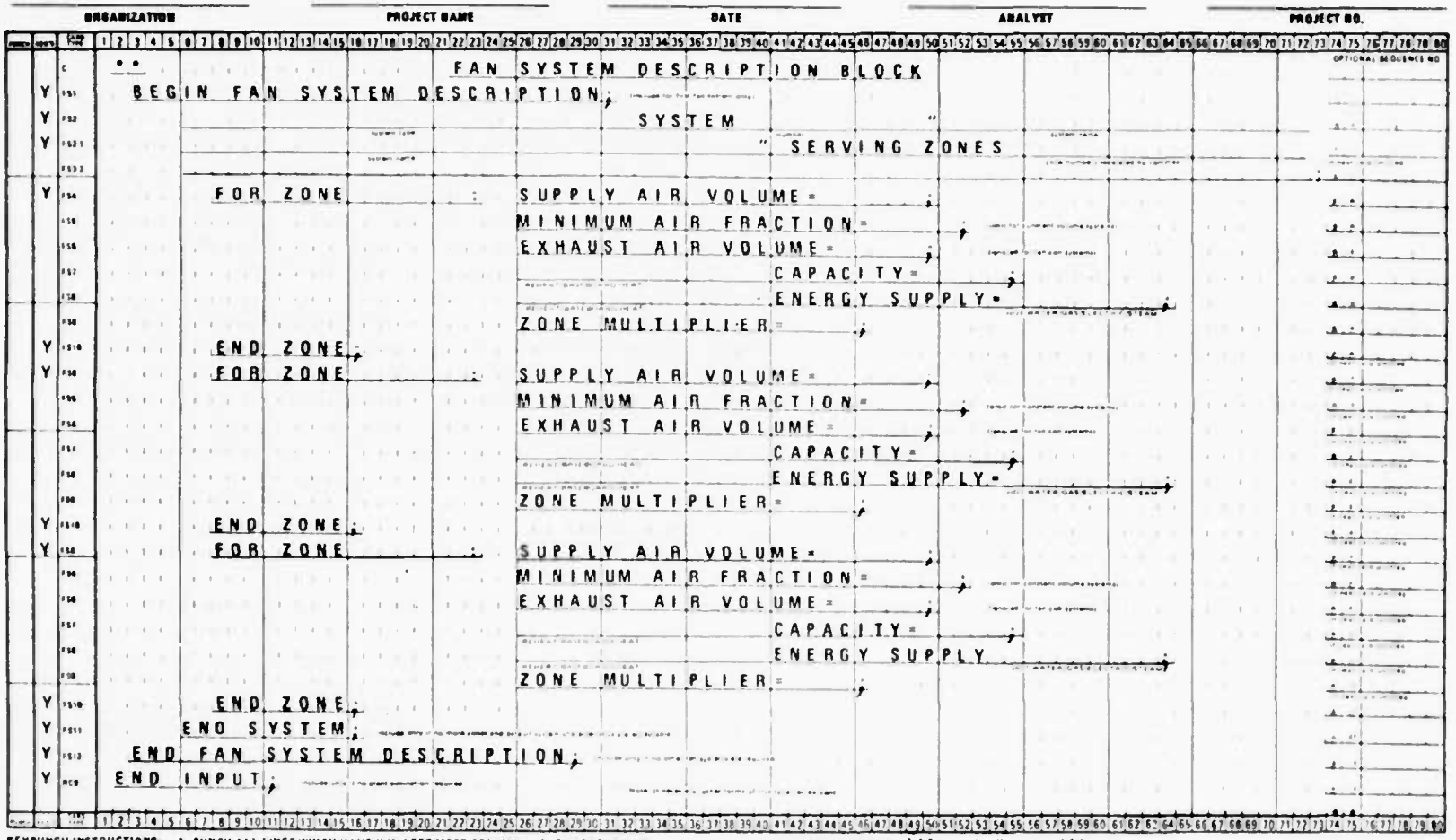
FS11 Ends the system description begun by the preceding FS2 card. Omit if more FS4 cards or other data for the fan system follow.

FS12 Ends the description of the entire building fan systems begun by FS1. Omit if more fan system data or FS2 cards follow.

RC9 Last card in BLAST input deck. Omit if input of any kind follows.

Table 4
System Types

TERMINAL REHEAT	DUAL DUCT VARIABLE VOLUME
VARIABLE VOLUME	SINGLE ZONE DRAW THRU
UNIT VENTILATOR	MULTIZONE
THREE DECK MULTIZONE	SUBZONE REHEAT
TWO PIPE FAN COIL	DX PACKAGED UNIT
FOUR PIPE FAN COIL	



KEYPUNCH INSTRUCTIONS. 1. PUNCH ALL LINES WHICH HAVE X IN LEFT MOST COLUMN. 2. CHARACTER SET (029/EBCDIC,026/BCD) 3. CONVENTIONS 1,¢,$ (ALPHA) ~ (SPECIAL) 1,0,5 (NUMERIC)

BLAST INPUT FORM 11

Fan system description

Input Form 12: OTHER SYSTEMS PARAMETERS

General note: Table 5 (page 75) indicates which OTHER SYSTEM PARAMETERS affect particular BLAST fan system types. Ignore those not affecting the system being described. Also, check defaults in the appendix (Table A1) of this Input Booklet (page 107) to avoid unnecessary cards.

0P1 Begins definition of OTHER SYSTEM PARAMETERS *for fan system defined on preceding* FS2 *card* (see Table 4).

0P2 Provide total SUPPLY FAN PRESSURE in inches of water (or Pascals) and SUPPLY FAN EFFICIENCY. The latter must be a fraction—it represents the *product of fan and motor efficiencies*.

0P3 Same as **0P2**, but for return fan. Omit if no return fan is used.

0P4 Same as **0P2**, but for *all* zone exhaust fans. Same values are applied to all exhaust fans in any and all zones attached to this system. Omit if none are used.

0P5 This card can be used to override the COLD DECK CONTROL default (which is FIXED SET POINT). If CONTROL is inserted in the first field, the control scheme (either OUTSIDE AIR CONTROLLED or ZONE CONTROLLED) must also be specified. If TEMPERATURE is inserted in the first field, the desired (fixed) set point in °F (or °C) must be entered in the second field.

0P6 Use this card to specify the range in cold-deck temperature in °F (or °C) over which the cooling coil control goes from "full on" to "full off." The cold-deck temperature will drop from the set point by this amount as the cooling load approaches zero.

0P7 If a nonfixed cold-deck control is specified (card **0P5**), use this card to establish the cold-deck reset schedule. Insert the low control input (i.e., either outside or zone temperature in °F [or °C]) and the corresponding desired set point in the first two fields. Similarly, insert the high control input and set point in the third and fourth fields. The set point is varied linearly in between, and *limited at the high and low* set points indicated [see Advanced Topics, Chapter 5].

0P8 Use to specify either GAS, ELECTRIC, or STEAM energy supply. Default is HOT WATER. Also, indicate capacity in kBtu/hr (or kW) of the coil. Default is 3,412,000 kBtu/hr (1 000 000 kW).

0P9 This card can be used to override the HOT DECK CONTROL default (which is FIXED SET POINT). Directions given for **0P5** apply.

0P10 Use this card to specify the range in hot-deck temperature over which the heating coil control goes from "full on" to "full off." The hot-deck temperature will rise by this amount from the set point as the heating load approaches zero.

0P11 If a nonfixed hot deck control is specified (**0P9**), use this card to establish the hot deck reset schedule. Directions given for **0P7** apply.

0P12 If outside air introduced by the air handler is to be other than FIXED PERCENT of instantaneous system volume, use this card to indicate the control. For *other than fan coil system*, FIXED AMOUNT, TEMPERATURE ECONOMY CYCLE, RETURN AIR ECONOMY CYCLE, or ENTHALPY ECONOMY CYCLE can be entered in the field. *This card is ignored for fan coil systems*, which always use FIXED PERCENT. Either FIXED PERCENT or FIXED AMOUNT will be varied according to the schedules or cards **0P15-18**.

0P13 By default, all BLAST economy cycles seek to achieve a mixed-air temperature equal to the cold-deck temperature. This card can override this by providing a fixed DESIRED MIXED AIR TEMPERATURE in °F (or °C). This card is ignored unless an economy cycle is indicated on **0P12**.

0P14 Use this card to specify the amount of outside air in ft^3/min (or m^3/s) for FIXED AMOUNT mixed-air control. Adjusted hourly by normalized schedules on **0P15** through **0P17**.

0P15 Provide weekday 24-hour profile of numbers between **0** and **1.0**. Separate each with a comma. Alternately, a sequence of the form **8 TO 17@0.9** can be used to set a group of hours to the same value. Note that in the above sequence, **0.9** is assigned to the interval between 8 am and

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```
Y    OTHER SYSTEM PARAMETERS:
       SUPPLY FAN PRESSURE=     ; SUPPLY FAN EFFICIENCY=     ;
       RETURN FAN PRESSURE=     ; RETURN FAN EFFICIENCY=     ;
       EXHAUST FAN PRESSURE=    ; EXHAUST FAN EFFICIENCY=    ;
       COLD DECK          =
       COLD DECK THROTTLING RANGE=    ;
       COLD DECK CONTROL SCHEDULE=(    AT    ,    AT    );
     HEATING COIL ENERGY SUPPLY=     ; HEATING COIL CAPACITY=     ;
       HOT DECK          =
       HOT DECK THROTTLING RANGE=    ;
       HOT DECK CONTROL SCHEDULE= (    AT    ,    AT    );
       MIXED AIR CONTROL=     ;
       DESIRED MIXED AIR TEMPERATURE=    ;
       OUTSIDE AIR VOLUME=    ;
       WEEKDAY MINIMUM OUTSIDE AIR SCHEDULE=(    );
       WEEKDAY MAXIMUM OUTSIDE AIR SCHEDULE=(    );
       WEEKEND MINIMUM OUTSIDE AIR SCHEDULE=(    );
       WEEKEND MAXIMUM OUTSIDE AIR SCHEDULE=(    );
       PREHEAT COIL LOCATION=    ;
       PREHEAT TEMPERATURE=    ;
       PREHEAT ENERGY SUPPLY=    ; PREHEAT COIL CAPACITY=    ;
       GAS BURNER EFFICIENCY=    ;
       VAV MINIMUM AIR FRACTION=    ;
       VAV VOLUME CONTROL=    ;
       FAN POWER COEFFICIENTS=(    );
HUMIDIFIER TYPE=    ; HUMIDISTAT LOCATION=    ; HUMIDSTAT SET POINT=    ;
Y    END OTHER SYSTEM PARAMETERS;
Y   END SYSTEM;
Y  END FAN SYSTEM DESCRIPTION;
Y  END INPUT;
```

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT MOST COLUMN. 2. CHARACTER SET (029/EBCDIC,026/BCD) 3. CONVENTIONS 1,Φ,S (ALPHA) (SPECIAL) 1,0,5 (NUMERIC)

BLAST INPUT FORM 12

Definition of other system parameters for fan systems (use for each fan system requiring non-default other system parameters)

Input Form 12: OTHER SYSTEMS PARAMETERS (cont'd)

5 pm. If FIXED PERCENT (default) mixed-air control is used, profiles are the *minimum fractions* of *total* system supply air which are introduced from the outside through the air handler. If FIXED AMOUNT is used, profiles are the *minimum fractions* of the amount on card 0P14. If EXHAUST AIR VOLUME is nonzero for any zone served, or if an ECONOMY cycle is used, there may be more outside air than this schedule indicates.

0P16 This card allows weekday control of the *maximum* amount of outside air; ignore this card unless an ECONOMY cycle is used. Instructions for 0P15 apply.

0P17 Same as 0P15, but for weekends.

0P18 Same as 0P16, but for weekends.

0P19 Preheat coil may be placed in OUTSIDE AIR DUCT or MIXED AIR DUCT if preheat is allowed for the system under description (see Table 4). If this card is omitted, no preheat is done, even though PREHEAT CAPACITY has been given on card 0P21; preheating requires cards 0P19 *and* 0P21.

0P20 Indicate outside air temperature in °F (or °C) at which preheating is to take place. If the preheat coil is in the MIXED AIR DUCT, it modulates to maintain this PREHEAT TEMPERATURE. If the preheat coil is in the OUTSIDE AIR DUCT, it comes on at *full capacity* at this PREHEAT TEMPERATURE. Omitting this card when the preheat coil is in the MIXED AIR DUCT will cause the preheat coil set point to be reset to the cold-deck set point.

0P21 Indicate HOT WATER, GAS, ELECTRIC, or STEAM preheat energy supply and the coil capacity in kBtu/hr (or kW).

0P22 Use this card to specify the GAS BURNER EFFICIENCY to be applied to all gas energy supplied heaters (i.e., gas duct heaters, gas humidifer, furnace, etc.) in this system. Used to determine *input* energy in the gas category. Gas consumption is summarized in Air Handling System Energy Use Summary Report and added to central plant boiler fuel consumption.

0P23 Use this card to specify the minimum volume fraction for the *fan* in a VAV system. Also used as VAV box minimum (if not given on card FS5).

0P24 Specify VAV fan control as VARIABLE FAN SPEED or DISCHARGE DAMPERS. Default is INLET VANES. Omit this card if 0P25 is used.

0P25 As an alternate means of specifying variation of fan power with flow fraction, the coefficients of a fourth-order polynomial can be given here as five numbers separated by commas. The first number is the constant term, the second is the linear coefficient, etc. Omit this card if 0P24 is used.

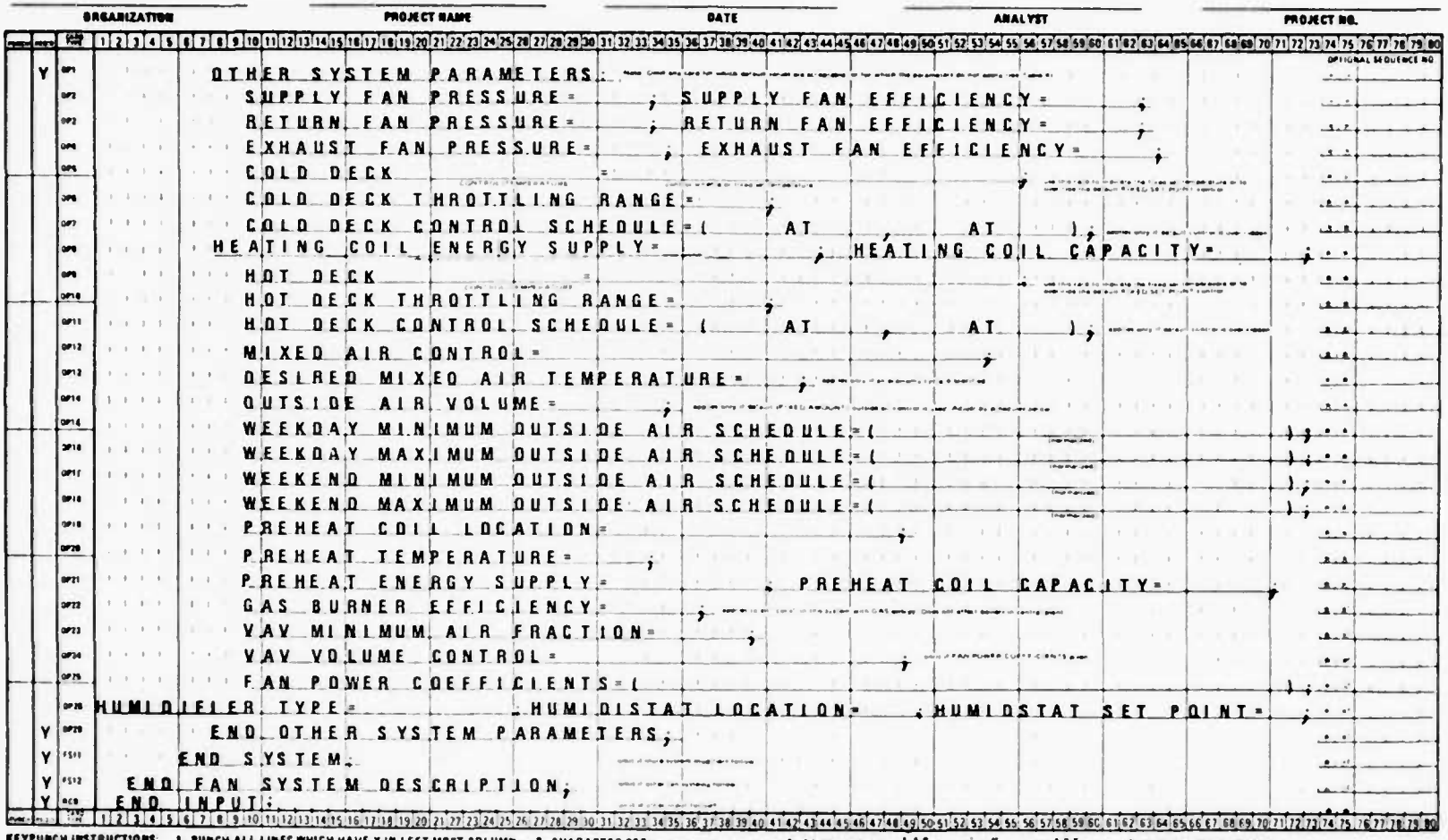
0P26 A STEAM, HOT WATER, GAS, or ELECTRIC humidifer can be specified for systems allowing humidifiers (see Table 5). Indicate the zone number where the humidistat is located. Indicate the humidistat set point as a percent (not fraction) of relative humidity.

0P27 Ends specification of OTHER SYSTEM PARAMETERS for the current system.

FS11 Ends system description begun by the preceding FS2 card. Omit if other data for this fan system follow.

FS12 Ends the description of the entire building fan systems begun by FS1. Omit if more fan system data or FS2 cards follow.

RC9 Last card in BLAST input deck. Omit if input of any kind follows.



KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT MOST COLUMN. 2. CHARACTER SET (026/EBCDIC,026/BCD) 3. CONVENTIONS 1,4,5 (ALPHA) ' (SPECIAL) 1,8,5 (NUMERIC)

BLAST INPUT FORM 12

Definition of other system parameters for fan systems (use for each fan system requiring non default other system parameters)

Input Form 13: Cooling Coil Design Parameters:

General note: Not all COOLING COIL DESIGN PARAMETERS affect a particular cooling coil type (see Table 6, page 76). However, when a particular coil type is to be changed from the default, *all parameters* applicable to that type *must* be entered. This set of values must represent an actual coil operating condition, such as that available from a manufacturer's catalog.

CC1 — Begins COOLING COIL DESIGN PARAMETER changes. Use only if defaults are not acceptable.

CC2 — Indicate CHILLED WATER or DIRECT EXPANSION (DX is acceptable) coil type.

CC3 — Enter AIR VOLUME FLOW RATE in ft^3/min (or m^3/s) for a known coil operating condition.

CC4 — Enter the BAROMETRIC PRESSURE in inches of water (or Pascals) for the operating point used in CC3.

CC5 — Enter AIR FACE VELOCITY in ft/min (or m/s) for the operating point used in CC3. Not used for fan coil units.

CC6 — Enter the ENTERING AIR DRY BULB TEMPERATURE in °F (or °C) for the operating point used in CC3.

CC7 — Enter the ENTERING AIR WET BULB TEMPERATURE in °F (or °C) for the operating point used in CC3.

CC8 — Enter the LEAVING AIR DRY BULB TEMPERATURE in °F (or °C) for the operating point used in CC3.

CC9 — Enter the LEAVING AIR WET BULB TEMPERATURE in °F (or °C) for the operating point used in CC3. Not used for fan coil units.

CC10 — Enter the ENTERING WATER TEMPERATURE in °F (or °C) for the operating point used in CC3. Not used for DX type coils.

CC11 — Enter the LEAVING WATER TEMPERATURE °F (or °C) for the operating point used in CC3. Not used for DX type coils.

CC12 — Enter the WATER VOLUME FLOW RATE in ft^3/min (or m^3/s) for the operating point used in CC3. Not used for DX type coils.

CC13 — Enter the WATER VELOCITY in ft/min (or m/s) for the operating point used in CC3. Not used for DX type coils.

CC14 — Enter the ENTERING REFRIGERANT TEMPERATURE °F (or °C) for the operating point used in CC3. Not used for water type coils.

CC15 — Enter the LEAVING REFRIGERANT TEMPERATURE °F (or °C) for the operating point used in CC3. Not used for water type coils.

CC16 — Enter the TOTAL COOLING LOAD (capacity) in kBtu/hr (or kW) for the coil and operating point used in CC3. Not used for water type coils.

CC17 — Enter the NUMBER OF parallel refrigerant TUBE CIRCUITS for the coil used in CC3. Not used for water type coils.

CC18, 19, 20 — Enter coefficients for DX package units (see Table 5) DXCOIL1, DXCOIL2, and DXCOIL3 [Chapter 5 and Appendix F].

CC21 — Ends the COOLING COIL DESIGN PARAMETERS begun on card CC1.

FS11 — Ends system description begun by previous FS2 card. Omit if other data for this system follow.

FS12 — Ends the description of the entire building fan systems begun by FS1. Omit if more fan systems data or FS2 cards follow.

RC9 — Last card in BLAST input deck. Omit if input of any kind follows.

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		Columns 1–80
	C	.. COOLING COIL DESIGN PARAMETERS
Y	CC1	COOLING COIL DESIGN PARAMETERS:
Y	CC2	COIL TYPE= ;
Y	CC3	AIR VOLUME FLOW RATE= ;
Y	CC4	BAROMETRIC PRESSURE= ;
Y	CC5	AIR FACE VELOCITY= ;
Y	CC6	ENTERING AIR DRY BULB TEMPERATURE= ;
Y	CC7	ENTERING AIR WET BULB TEMPERATURE= ;
Y	CC8	LEAVING AIR DRY BULB TEMPERATURE= ;
Y	CC9	LEAVING AIR WET BULB TEMPERATURE= ;
	C	.. ADDITIONAL DATA FOR WATER TYPE COILS
Y	CC10	ENTERING WATER TEMPERATURE= ;
Y	CC11	LEAVING WATER TEMPERATURE= ;
Y	CC12	WATER VOLUME FLOW RATE= ;
Y	CC13	WATER VELOCITY= ;
	C	.. ADDITIONAL DATA FOR DIRECT EXPANSION COILS
Y	CC14	ENTERING REFRIGERANT TEMPERATURE= ;
Y	CC15	LEAVING REFRIGERANT TEMPERATURE= ;
Y	CC16	TOTAL COOLING LOAD= ;
Y	CC17	NUMBER OF TUBE CIRCUITS= ;
Y	C	.. ADDITIONAL DATA FOR PACKAGED DX COILS
Y	CC18	DXCOIL1(, ,);
Y	CC19	DXCOIL2(, ,);
Y	CC20	DXCOIL3(, ,);
Y	CC21	END COOLING COIL DESIGN PARAMETERS;
Y	FS11	END SYSTEM;
Y	FS12	END FAN SYSTEM DESCRIPTION;
Y	RC0	END INPUT;

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT MOST COLUMN. 2. CHARACTER SET (029/EBCDIC,026/BCD) 3. CONVENTIONS 1,Φ,S (ALPHA) : - (SPECIAL) 1,0,6 (NUMERIC)

BLAST INPUT FORM 13

Definition of cooling coil design parameters (use if default coils are not acceptable)

Input Form 14: DX Condensing Unit and Heat Recovery Parameters

General:

If any of the DX cards are used, *all* must be included. The parameters given must represent an actual operating point for the condensing unit being modeled.

DX1 Begins input sequence for DX condensing unit parameters. Omit if default unit is acceptable.

DX2 Enter the saturated suction temperature in °F (or °C) for the design operating point.

DX3 Enter the saturated condensing temperature in °F (or °C) for the same point used in DX2.

DX4 Enter the minimum allowable saturated condensing temperature in °F (or °C) for the unit being modeled.

DX5 SCT TEMPERATURE RISE is the ratio of the difference between real and design saturated condensing temperature to the difference between real and design saturated suction temperature [Appendix F].

DX6 Enter the capacity of the DX condensing unit in kBtu/hr (or kW) at the operating point used in DX2 and DX3.

DX7 Enter the effective condensing coil UA product in kBtu/hr-°F (or kW/°C) for the unit being modeled [Appendix F].

DX8 Enter the ratio of power required (compressor and fan) to the capacity at the operating point used in DX2 and DX3.

DX9 Enter the change in saturated suction temperature in °F (or °C) over which compressor unloading takes place [Appendix F].

DX10 Enter the curve-fit coefficients which describe the variation in normalized capacity with equivalent temperature difference [Appendix F].

DX11 Enter the curve-fit coefficients for the fraction of full-load power (vs) part-load ratio [Appendix F].

DX12 Enter the curve-fit coefficients for the variation of normalized full-load power ratio with Carnot efficiency [Appendix F].

DX13 Ends the DX condensing unit parameters begun with DX1.

HR1 Begins sequence of air-to-air heat recovery parameters.

HR2.1-3 Heat recovery effectiveness coefficients [Chapter 5] HTREC1, HTREC2, and HTREC3.

HR3 Heat recovery energy consumption coefficients [Chapter 5].

HR4 Enter nominal capacity of heat recovery device.

HR5 Ends the heat recovery parameters begun with HR1.

FS11 Ends system description begun by previous FS2 card. Omit if other data for this system follow.

FS12 Ends the description of the entire building fan systems begun by FS1. Omit if more fan systems data or FS2 cards follow.

RC9 Last card in BLAST input deck. Omit if input of any kind follows.

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```
Y  C     ..        DX  CONDENSING UNIT PARAMETERS
Y  DA1           DX CONDENSING UNIT PARAMETERS:
Y  DA2             DESIGN SATURATED SUCTION TEMPERATURE=        ;
Y  DA3             DESIGN SATURATED CONDENSING TEMPERATURE=        ;
Y  DA4             MINIMUM SATURATED CONDENSING TEMPERATURE=        ;
Y  DA5             SCT TEMPERATURE RISE=        ;
Y  DA6             DX CONDENSING UNIT CAPACITY=        ;
Y  DA7             CONDENSER UA=        ;
Y  DA8             DESIGN FULL LOAD POWER RATIO=        ;
Y  DA9             UNLOADER THROTTLING RANGE=        ;
Y  DA10            RCAVCD  (      ,      ,      );
Y  DA11            RPWRCD  (      ,      ,      );
Y  DA12            ADJECD  (      ,      ,      );
Y  DA13          END DX CONDENSING UNIT PARAMETERS;
   C     ..              RELIEF AIR HEAT RECOVERY EQUIPMENT SPECIFICATIONS
Y  HA1           HEAT RECOVERY PARAMETERS:
Y  HA21              HTREC1(      ,      ,      );
Y  HA22              HTREC2(      ,      ,      );
Y  HA23              HTREC3(      ,      ,      );
Y  HA3               HTPWR (      ,      ,      );
Y  HA4               HEAT RECOVERY CAPACITY=        ;
Y  HA5           END HEAT RECOVERY PARAMETERS;
Y  F211         END SYSTEM;
Y  F312      END FAN SYSTEM DESCRIPTION;
Y  HC0     END INPUT;
```

OPTIONAL SEQUENCE NO.

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (026/EBCDIC,026/BCD) 3. CONVENTIONS 1,Φ,S (ALPHA) : - (SPECIAL) 1,0,5 (NUMERIC)

BLAST INPUT FORM 14

Definition of DX condensing unit and relief air heat recovery parameters.

Input Form 15: Equipment Schedules

ES1 Begins definition of distribution system equipment schedules.

ES2 Enter INTERMITTENT unless fans are to run every hour of every day, regardless of load. CONTINUOUS (the default) defeats the schedules below.

ES3 Describe the weekday fan ontime. For example, 18 TO 7-OFF, 7 TO 18-ON. In this example, fans are on regardless of load from 7 am to 6 pm, and come on *only if there is a load* between 6 pm and 7 am.

ES4 Same as ES3, but describes weekend fan operation.

ES5 Use this card to indicate the heating season if heating coil energy is only supplied during that time. Defaults to year-round availability if omitted.

ES6 Use this card to indicate the weekday hours during which heating energy is supplied to the coils. This schedule is described as in ES3.

ES7 Same as ES6, but for weekends.

ES8 Same as ES5, but for cooling coils.

ES9 Same as ES6, but for cooling coils.

ES10 Same as ES7, but for cooling coils.

ES11 Same as ES5, but for any preheat coils which may have been specified.

ES12 Same as ES6, but for any preheat coils which may have been specified.

ES13 Same as ES7, but for any preheat coils which may have been specified.

ES14 Same as ES5, but for any heat recovery units which may have been specified. If heat recovery is specified, this card must be completed, since the default for heat recovery is off, if omitted.

ES15 Same as ES6, but for any heat recovery units which may have been specified.

ES16 Same as ES7, but for any heat recovery units which may have been specified.

ES17 Ends definition of fan system schedules begun with ES1.

FS11 Ends system description begun by previous FS2 card. Omit if other data for this system follows.

FS12 Ends the description of the entire building fan systems begun by FS1. Omit if more fan systems data or FS2 cards follow.

RC9 Last card in BLAST input deck. Omit if input of any kind follows.

ORGANIZATION ______ PROJECT NAME ______ DATE ______ ANALYST ______ PROJECT NO. ______

Punch	Card Type	Columns 1–80
	C	** FAN SYSTEM EQUIPMENT SCHEDULES
Y	ES1	EQUIPMENT SCHEDULES:
	C	** FANS
	ES2	SYSTEM OPERATION=INTERMITTENT ;
	ES3	WEEKDAY SYSTEM SCHEDULE=(07 TO 17-1, 17 TO 07-0);
	ES4	WEEKDAY SYSTEM SCHEDULE=(00 TO 24-0);
	C	** HEATING COILS
	ES5	HEATING CAPACITY ON FROM ___ THRU ___ ;
	ES6	WEEKDAY HEATING SCHEDULE=( );
	ES7	WEEKEND HEATING SCHEDULE=( );
	C	** COOLING COILS
	ES8	COOLING CAPACITY ON FROM ___ THRU ___ ;
	ES9	WEEKDAY COOLING SCHEDULE=( );
	ES10	WEEKEND COOLING SCHEDULE=( );
	C	** PREHEAT COILS
	ES11	PREHEAT CAPACITY ON FROM ___ THRU ___ ;
	ES12	WEEKDAY PREHEAT SCHEDULE=( );
	ES13	WEEKEND PREHEAT SCHEDULE=( );
	C	** HEAT RECOVERY UNITS
	ES14	HEAT RECOVERY ON FROM ___ THRU ___ ;
	ES15	WEEKDAY HEAT RECOVERY SCHEDULE=( );
	ES16	WEEKEND HEAT RECOVERY SCHEDULE=( );
Y	ES17	END EQUIPMENT SCHEDULES;
Y	FS11	END SYSTEM;
Y	FS12	END FAN SYSTEM DESCRIPTION;
Y	RC9	END INPUT;

OPTIONAL SEQUENCE NO

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (029/EBCDIC,026/BCD) 3. CONVENTIONS 1,Ø,S (ALPHA) : " (SPECIAL) 1,0,5 (NUMERIC)

BLAST INPUT FORM 15

Fan system equipment schedules (use to control when fans are to be on regardless of load, and to specify when coil energy is available)

Input Form 16: Central Plant Card Types

CP1 Begins description of all central plants.

CP2 Provide a unique number, six digits or less, and a name for the central plant being described.

CP3 From those fan systems simulated in this run or previously stored on the AHLDFL file [Appendix B], list those served by this central plant. Separate each with a comma. ALL can be specified if all systems are being served by the plant.

CP4 Begins specification of domestic hot water schedules. Omit CP4 through CP7 if no domestic hot water.

CP5.1 Provide weekday 24-hour profile of numbers representing hot water demand in kBtu/hr (or kW). Separate each with a comma. A sequence of the form 8 TO 17-2.5 can be used to set a group of hours to the same value; in this example, 2.5 kBtu/hr is specified for the interval between 8 am and 5 pm. CP5.1 must end with a parenthesis and semicolon if next card omitted.

CP5.2 Continuation of CP5.1; use if required.

CP6.1-6.2 Same as CP5.1-5.2, but for weekend hot water demand.

CP7 Ends domestic hot water schedules.

CP8 Begins selection of central plant equipment.

CP9 Use to indicate particular kinds of central plant equipment. In the first field, indicate the number of this type *installed*. In the second field, indicate the type from among those listed in Table 7. In the next field, indicate the size in kBtu/hr (or kW) for all but solar collectors and tanks: sq ft (or m^2) for solar collectors; kBtu (or kWh) for tanks. Finally, indicate the number available at any instant. Those installed but not available are spares; they affect capital cost but not energy. Use as many of CP9 cards as there are distinct sizes and types of equipment.

CP10 Ends selection of central plant equipment.

CP11 Begin specification of part-load ratio for central plant equipment. Use if default characteristics of any type are not acceptable.

CP12.1 Enter equipment types from among those selected on CP9 cards. MIN, MAX, and BEST represent the ratio of load-to-nominal load for minimum allowable, maximum allowable, and optimum operation, respectively. If the next card not used, close with parenthesis and semicolon. Use as many CP12.1 cards as necessary to describe all types of equipment. Note that all *sizes* of a given type are similar in this respect. [Chapter 6]

CP12.2 Use this card to indicate the ratio of electrical power input to useful output effect at the design operating point. Applies to all equipment of the type given on CP12.1. [Chapter 6 and Appendix G]

CP13 End specification of central plant part-load ratios.

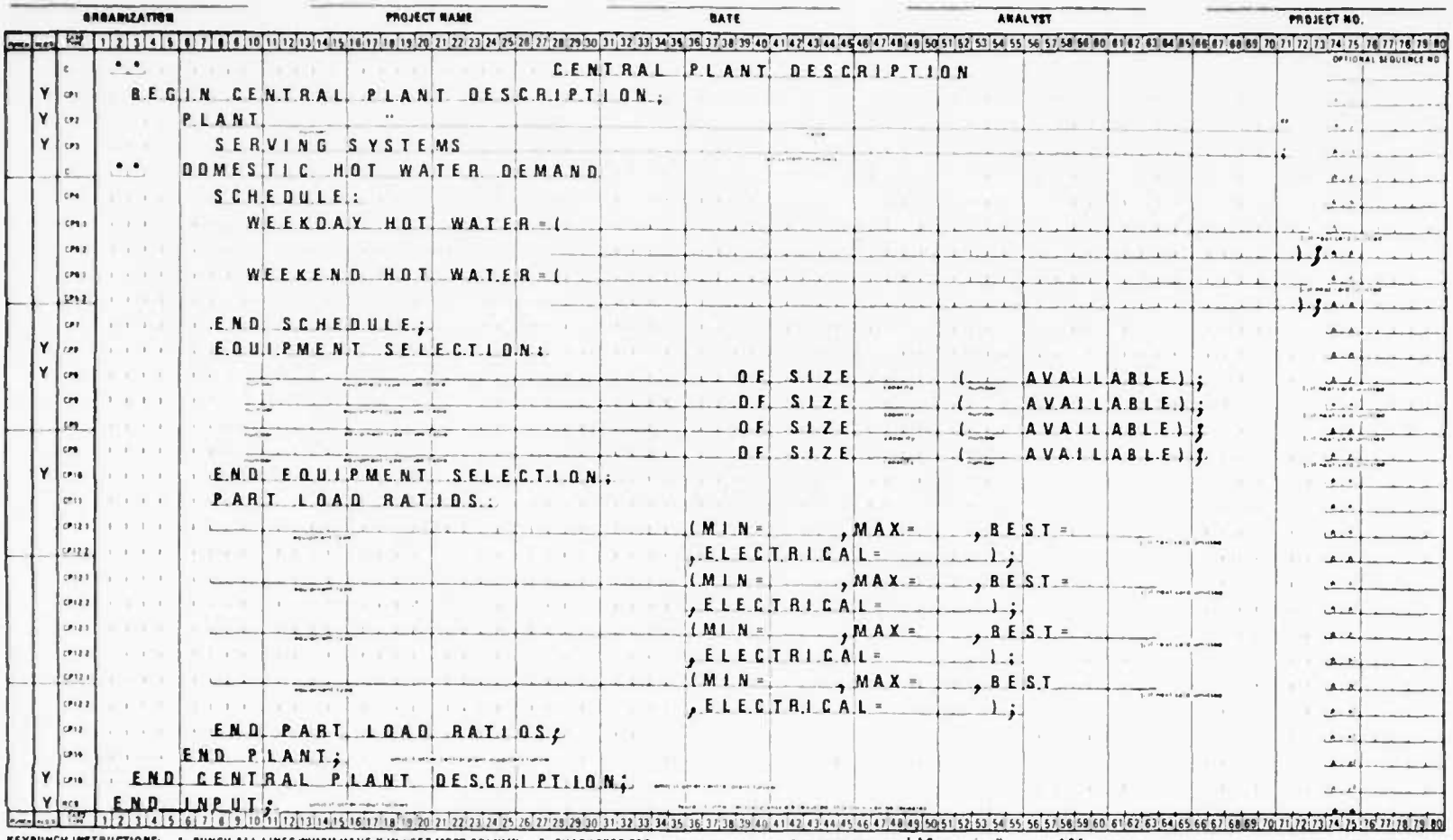
CP14 Ends description of central plant begun with preceding CP2 card. Omit if other data for this central plant follow.

CP15 Ends the description of all central plants begun by CP1 card. Omit if more central plant data or CP2 cards follow.

RC9 Last card in BLAST input deck. Omit if input of any kind follows.

Table 7
Equipment Types

BOILER	HOT STORAGE TANK
CERAMIC COOLING TOWER	ONE-STAGE ABSORBER
CHILLER	OPEN CHILLER
COLD STORAGE TANK	RECIPROACTING CHILLER
COOLING TOWER	SOLAR COLLECTORS
DIESEL GENERATOR	STEAM TURBINE
DOUBLE-BUNDLE CHILLER	TWO-STAGE ABSORBER
GAS TURBINE	TWO-STAGE ABSORBER W/ECON
HEAT PUMP	



KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT MOST COLUMN. 2. CHARACTER SET (029/EBCDIC,026/BCD) 3. CONVENTIONS I,J,S (ALPHA) : " (SPECIAL) I,J,S (NUMERIC)

BLAST INPUT FORM 16

Central plant descriptions

Input Form 17: Equipment Assignment Card Types

EA1 Begins specification of central plant strategy for assignment of equipment to the load. If EA1-4 are omitted, BLAST will assign equipment according to an optimum strategy [Appendix G].

EA2 Enter an equipment type from among those selected on CP9 cards. EA2 can be repeated as often as needed.

EA3 In the first field, enter the maximum load in kBtu/hr (or kW) for which the succeeding list of equipment assignments is to be used. In the second field, enter a list of integers separated by commas. Use one integer for each *size* of equipment of this type. The first integer represents the number of the first-mentioned size (on the CP9 cards) to be used, the second integer is the number of the second size; and so on. Each integer must be less than or equal to the *available* number for that size.

EA4 Ends specification of equipment assignment strategies.

CP14 Ends description of central plant begun with preceding CP2 card. Omit if other data for this central plant follow.

CP15 Ends the description of all central plants begun by CP1 card. Omit if more central plant data or CP2 cards follow.

RC9 Last card in BLAST input deck. Omit if input of any kind follows.

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO.

```
C   **      CENTRAL PLANT EQUIPMENT ASSIGNMENT STRATEGY
Y  EA1    EQUIPMENT ASSIGNMENT:
Y  EA2           ______________________;
Y  EA3       FOR L=     USE(__________),
Y  EA3       FOR L=     USE(__________),
   EA3       FOR L=     USE(__________),
   EA3       FOR L=     USE(__________),
   EA3       FOR L=     USE(__________),
   EA2           ______________________;
   EA3       FOR L=     USE(__________),
   EA3       FOR L=     USE(__________),
   EA3       FOR L=     USE(__________),
   EA3       FOR L=     USE(__________),
   EA3       FOR L=     USE(__________),
   EA2           ______________________;
   EA3       FOR L=     USE(__________),
   EA3       FOR L=     USE(__________),
   EA3       FOR L=     USE(__________),
   EA3       FOR L=     USE(__________),
   EA3       FOR L=     USE(__________),
   EA2           ______________________;
   EA3       FOR L=     USE(__________),
   EA3       FOR L=     USE(__________),
   EA3       FOR L=     USE(__________),
   EA3       FOR L=     USE(__________),
   EA3       FOR L=     USE(__________),
   EA4    END EQUIPMENT ASSIGNMENT;
Y  CP18  END PLANT;
Y  CP19 END CENTRAL PLANT DESCRIPTION;
Y  PC9  END INPUT
```

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT MOST COLUMN. 2. CHARACTER SET ______ (029/EBCDIC,026/BCD) 3. CONVENTIONS 1,0,S (ALPHA) : " (SPECIAL) 1,9,5 (NUMERIC)

BLAST INPUT FORM 17

Central plant equipment assignment
(use to override BLAST optional assignment rule)

Input Form 18: Equipment Parameters

General note: Cards of the EP type allow the user to change certain characteristics of the central plant equipment. Not all card types have meaning for a particular type of equipment, as shown in Table 8, page 77. For this reason, four different Input Forms deal with SPECIAL PARAMETERS. Each provides the card types necessary for specifying parameters for a common group of central plant equipment. The user should select the most appropriate form for the building being simulated. If defaults are acceptable, any or all of these card types can be omitted.

EP1 Begins specification of central plant SPECIAL PARAMETERS. Use only one card of this type for each CENTRAL PLANT.

EP2 TOTUEF is the overall efficiency of the utility producing purchased electric power. Default TOTUEF = 0.3.

EP3 RFLASH is the ratio of boiler make-up mass flow rate to total steam or hot water mass flow rate delivered to the load. RHFLASH is the fraction of the blowdown loss which is recovered with a feed-water preheater. TWMAKE is the make-up water temperature in °F (or °C). TSATUR is the saturated steam temperature or the boiler hot water temperature in °F (or °C).

EP4 TLEAVE is the boiler stack leaving temperature affecting boiler efficiency. SRATB and HFUELB are the stoichiometric ratio and heat content of fuel in Btu/lb (or kJ/kg).

EP5 PELHT is the ratio of electrical power for hot water circulating pumps to installed boiler capacity [Appendix G]. STEAM is the enthalpy of boiler steam and PSTEAM is the gauge boiler steam pressure.

EP6 Enter the fraction of the available double-bundle chiller condenser heat which is recoverable. Omit if no double-bundle chillers are specified on a CP9 type card. TCOOL is the leaving chilled water temperature.

EP7 Same as EP6, but for heat pump.

EP8 PELCL is the ratio of electrical power for chilled and water pumps to installed chiller capacity [Appendix G]. TCW is the leaving condenser water temperature for double-bundle chillers and heat pumps when supplying heat.

EP9 PELTWR is the ratio of electrical power for cooling tower pumps to the installed cooling tower capacity [Appendix G].

EP10 Enter the ratio of condenser water flow rate to vapor-compression chiller capacity in lb/kBtu (or kg/kJ). Used to establish the condenser water flow rate for compression chillers only.

EP11 Same as EP10; use only if a double-bundle chillet has been specified on CP9 cards.

EP12 Same as EP10; use only if a heat pump has been specified on CP9 cards.

EP13 Use to specify the operational mode of the cooling tower circuit. Enter a 1 if variable water flow rate is required. Default is 2, fixed water flow rate. TTOWR is the minimum allowable water temperature leaving the tower.

EP14 These cards are provided so that the user can specify any other SPECIAL PARAMETERS not allowed for in the previous EP cards (see Table 8). Alternately, additional Input Forms 19, 20, 21, or 22 can be used.

EP15 Ends the specification of central plant SPECIAL PARAMETERS. Omit if others follow.

CP14 Ends description of central plant begun with preceding CP2 card. Omit if other data for this central plant follow.

CP15 Ends the description of all central plants begun by CP1 card. Omit if more central plant data or CP2 cards follow.

RC9 Last card in BLAST input deck. Omit if input of any kind follows.

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO.

```
C       • •   SPECIAL EQUIPMENT PARAMETERS
Y  EP1        SPECIAL PARAMETERS:
   EP2           TOTUEF=      ;
C       • •   BOILER PARAMETERS
   EP3           RFLASH=      ;   RHFLASH=      ;  TWMAKE=      ;  TSATUR=      ;
   EP4           TLEAVE=      ;          SRATB=      ;          HFUELB=      ;
   EP5           PELHT =      ;          STEAM=      ;          PSTEAM=      ;
C       • •   CHILLER AND HEAT PUMP PARAMETERS
   EP6           RAVRHDB=      ;                                TCOOL  =      ;
   EP7           RAVRHHP=      ;
   EP8           PELCL  =      ;                                TCW    =      ;
C       • •   COOLING TOWER PARAMETERS
   EP9           PELTWR =      ;
   EP10          RWCC=      ;
   EP11          RWCDB=      ;
   EP12          RWCHP=      ;
   EP13          TOWOPR=      ;          TTOWB=      ;
C       • •   OTHER SPECIAL PARAMETERS
   EP14
   EP14
   EP14
   EP14
   EP14
Y  EP16       END SPECIAL PARAMETERS;
   CP16     END PLANT;
Y  CP16   END CENTRAL PLANT DESCRIPTION;
Y  RC0  END INPUT;
```

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT MOST COLUMN. 2. CHARACTER SET (029/EBCDIC,026/BCD) 3. CONVENTIONS 1,0,S (ALPHA) : " (SPECIAL) 1,0,5 (NUMERIC)

BLAST INPUT FORM 18

Central plant equipment parameters boilers and vapor compression machines and their cooling towers

Input Form 19: Special Parameters for Boilers, Absorption Chillers, and Cooling Towers

EP1 Begins specification of central plant SPECIAL PARAMETERS. Use only one card of this type for each CENTRAL PLANT.

EP2 TOTUEF is the overall efficiency of the utility producing purchased electric power. Default TOTUEF = 0.3.

EP3 RFLASH is the ratio of boiler make-up mass flow rate to total steam or hot water mass flow rate delivered to the load. RHFLASH is the fraction of the blowdown loss which is recovered with a feed-water preheater. TWMAKE is the make-up water temperature in °F (or °C). TSATUR is the boiler hot water temperature in °F (or °C).

EP4 TLEAVE is the boiler stack leaving temperature affecting boiler efficieney. SRATB is the stoichiometric ratio; HFUELB is the heat content of fuel in kBtu/lb (kJ/kg).

EP5 PELHT is the ratio of electrical power for hot water circulating pumps to installed boiler capacity [Appendix G].

EP16 PSTEAM is the gauge boiler steam pressure (equivalent saturation pressure for hot water boilers) in inches of water, gauge (or Pascals, gauge). If not specified, default is 285 inches water gauge (10.3 psig); if two-stage absorber is selected, default is 3990 inches water gauge (144 psig). Affects performance of absorption chillers, and to a lesser extent, boiler performanee.

EP17 STEAM is the enthalpy of steam from boiler or heat recovery in Btu/lb (or kJ/kg); also enthalpy of steam to absorbers. If not specified, STEAM will be calculated as the saturation enthalpy at PSTEAM. TSATUR is (1) the steam saturation temperature or boiler hot water temperature in °F (or °C), (2) the inlet temperature to absorber at full capacity, and (3) the temperature at which heat will be recovered from diesel and gas turbine engine generators. If not specified, TSATUR will be calculated on the basis of PSTEAM.

EP18 TMINC is the minimum solar storage tank temperature in °F (or °C) below which absorption cooling cannot be accomplished with solar energy. Omit unless solar collectors are specified on CP9 card.

EP21 TCOOL is the chilled water temperature as it leaves the chiller operating at the design point. Affects performance of absorption chillers.

EP22 TTOWR is the minimum allowable temperature in °F (or °C) of water entering the absorption chiller from the cooling tower.

EP9 PELTWR is the ratio of electrical power for cooling tower pumps to the installed cooling tower capacity.

EP23 Enter the ratio of cooling tower (condenser) flow rate to absorption chiller capacity in lb/kBtu (or kg/kJ). Used to establish cooling tower water flow rate.

EP13 Use to specify the operational mode of the cooling tower circuit. Enter a 1 if variable water flow rate is required. Default is 2, fixed water flow rate. TTOWR is the minimum allowable water temperature leaving the tower.

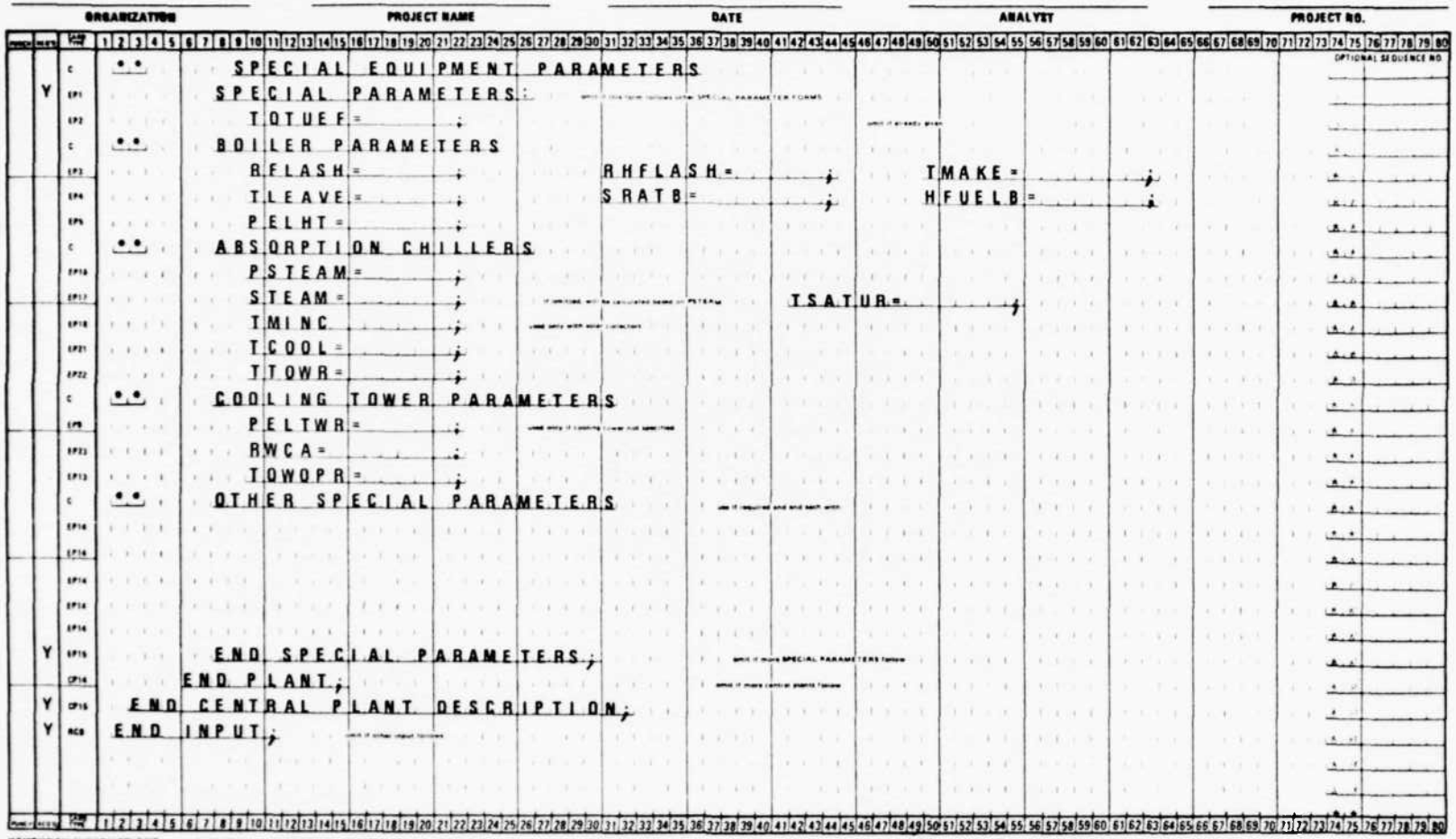
EP14 These cards are provided so that the user can specify any other SPECIAL PARAMETERS not allowed for in the previous EP cards (see Table 8). Alternately, additional Input Forms 19, 20, 21, or 22 can be used.

EP15 Ends the specification of central plant SPECIAL PARAMETERS. Omit if others follow.

CP14 Ends description of central plant begun with preceding CP2 card. Omit if other data for this central plant follow.

CP15 Ends the description of all central plants begun by CP1 card. Omit if more central plant data or CP2 cards follow.

RC9 Last card in BLAST input deck. Omit if input of any kind follows.



BLAST INPUT FORM 19

Central plant equipment parameters Boilers, absorption chillers and their cooling towers

BLAST Input Form 20: Special Parameters for Engine Generators

EP1 Begins specification of central plant SPECIAL PARAMETERS. Use only one card of this type for each CENTRAL PLANT.

EP2 TOTUEF is the overall efficiency of utility producing purchased electric power. Default TOTUEF = 0.3.

EP24 RMXKWG is the maximum exhaust flow per unit capacity for gas turbine engines. The parameter sets an upper limit on exhaust gas flow and exhaust gas heat recovery for gas turbine engines. Omit unless gas turbines are specified on CP9 cards.

EP16 PSTEAM is the gauge boiler steam pressure (equivalent saturation pressure for hot water boilers) in inches of water, gauge (or Pascals, gauge). If not specified, default in 285 inches water gauge (10.3 psig); if two-stage absorber is selected, default is 3990 inches water gauge (144 psig). Affects performance of absorption chillers, and to a lesser extent, boiler performance.

EP17 STEAM is the enthalpy of steam from boiler or heat recovery in Btu/lb (or kJ/kg); also enthalpy of steam to absorbers. If not specified, STEAM will be calculated as the saturation enthalpy at PSTEAM. TSATUR is (1) the steam saturation temperature or boiler hot water temperature in °F (or °C), (2) the inlet temperature to absorber at full capacity, and (3) the temperature at which heat will be recovered from diesel and gas turbine engine generators. If not specified, TSATUR will be calculated on the basis of PSTEAM.

EP25 Same as EP24, except for diesel engines.

EP26 Steam driving turbines are considered separately from steam driving absorbers, and their entering condition is given here. Enter pressure in inches of water, gauge (or Pascals, gauge), and the temperature in °F (or °C).

EP27 RWSTUR is the ratio of condensate flow to steam flow entering the turbine; the difference from 1.0 is steam and condensate leakage in the turbine.

EP28 Enter the steam turbine speed (RPM).

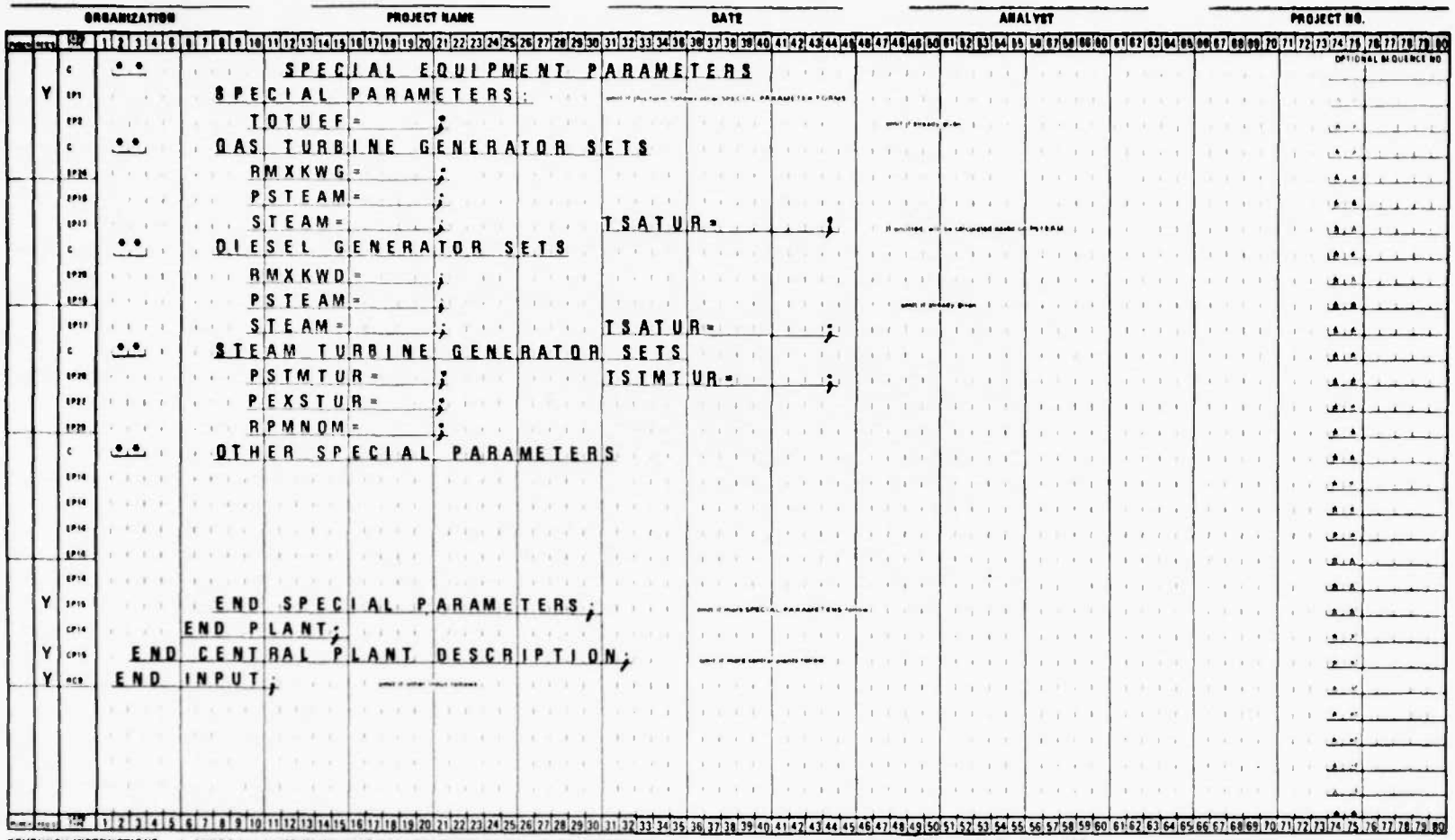
EP14 These cards are provided so that the user can specify any other SPECIAL PARAMETERS not allowed for in the previous EP cards (see Table 8). Alternately, additional Input Forms 19, 20, 21, or 22 can be used.

EP15 Ends the specification of central plant SPECIAL PARAMETERS. Omit if others follow.

CP14 Ends description of central plant begun with preceding CP2 card. Omit if other data for this central plant follow.

CP15 Ends the description of all central plants begun by CP1 card. Omit if more central plant data or CP2 cards follow.

RC9 Last card in BLAST input deck. Omit if input of any kind follows.



BLAST INPUT FORM 20

Central plant equipment perameters Total energy systems – generation equipment

BLAST Input Form 21: Special Parameters for Solar Energy Systems

EP1 Begins specification of central plant SPECIAL PARAMETERS. Use only one card of this type for each CENTRAL PLANT.

EP2 TOTUEF is the overall efficiency of the utility producing purchased power. Default TOTUEF = 0.3.

EP29 If solar collectors are specified on a CP9 card, specify the TILT in degrees from the horizontal, and facing AZMUTH in degrees clockwise from the *compass* (not building) north.

EP30 FLOWRT is the mass flow of water through solar collectors (equivalent mass flow if other fluids are used) per unit collector area in lb/hr-sq ft (or kg/s-m^2). If fluids other than water are used, FLOWRT is computed using the actual flow rate multiplied by the ratio of the specific heat of the other fluid to the specific heat of water.

EP31 HTXEFF is the effectiveness of the heat exchanger between the solar collector fluid loop and the thermal storage tank fluid loop. If none, use 1.0.

EP32 TNKCAP is the solar thermal storage capacity per unit collector area in lb/sq ft (or kg/m^2).

EP33 TNKTEM is the initial solar storage tank temperature in °F (or °C).

EP34 MXTNKT is the maximum allowable solar storage tank temperature in °F (or °C).

EP35 TMINH is the minimum solar storage tank temperature in °F (or °C) below which heating cannot be accomplished with solar energy.

EP36 TMINC is the minimum solar storage tank temperature in °F (or °C) below which cooling cannot be accomplished with solar energy.

EP37 TMINHP is the minimum solar storage tank temperature in °F (or °C) below which false loading of the heat pump cannot be accomplished with solar energy. Omit if no heat pump specified on CP9 card.

EP14 These cards are provided so that the user can specify any other SPECIAL PARAMETERS not allowed for in the previous EP cards (see Table 8). Alternately, additional Input Forms 19, 20, 21, or 22 can be used.

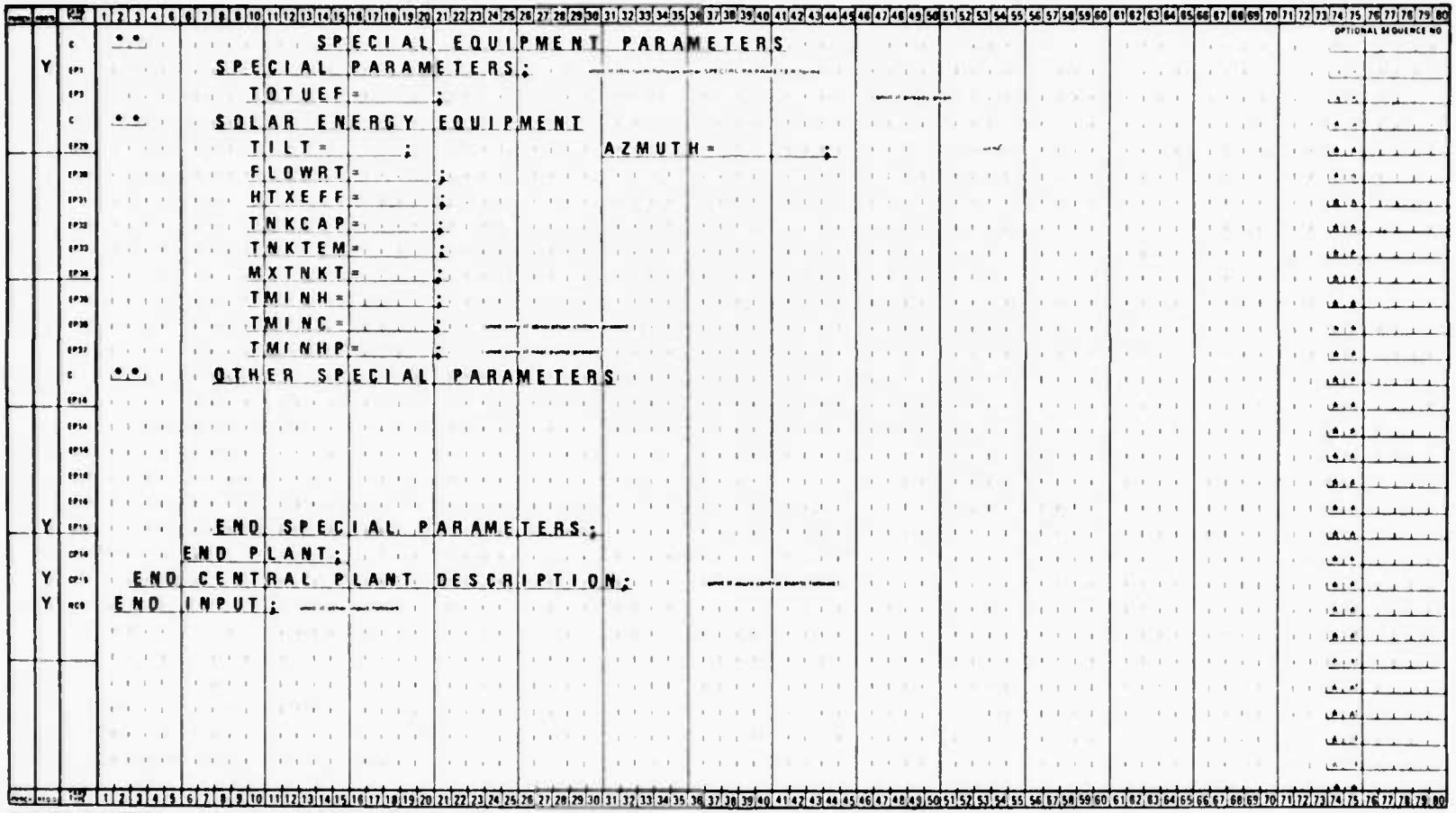
EP15 Ends the specification of central plant SPECIAL PARAMETERS. Omit if others follow.

CP14 Ends description of central plant begun with preceding CP2 card. Omit if other data for this central plant follow.

CP15 Ends the description of all central plants begun by CP1 card. Omit if more central plant data or CP2 cards follow.

RC9 Last card in BLAST input deck. Omit if input of any kind follows.

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO.



KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (026/EBCDIC, 026/BCD) 3. CONVENTIONS 1.0$ (ALPHA) : = (SPECIAL) 1.0.0 (NUMERIC)

BLAST INPUT FORM 21

Central plant equipment parameters Solar energy system

BLAST Input Form 22: Equipment Performance Parameters for Boilers, Chillers, Heat Pumps, and Cooling Towers

General note: Equipment performance parameters which vary with operating conditions and load are determined in BLAST from curve-fit equations. The user can determine the coefficients for specific equipment, as outlined in Appendix G of the Users Manual. The card types listed below allow entry of these coefficients. The first, second, and third entries represent the constant, linear coefficient, and quadratic coefficient, respectively. Zeros must be entered if required by the curve fit. Any or all cards may be omitted if defaults are acceptable, or if the indicated equipment is not present on CP9 cards.

PP1 Begins specification of central plant equipment off-design performance curves.

PP2 RFUELB coefficients represent the actual to theoretical boiler efficiency ratio vs part-load ratio. HPUMP are the heating pump power coefficients [Appendix G].

PP3 RPWR1C coefficients represent the fraction of full-load power input vs part-load ratio for a hermetic centrifugal vapor-compression chiller. RCAV1C coefficients represent a capacity correction vs an equivalent temperature difference between leaving chilled water and leaving condenser water temperature [Appendix G].

PP4 ADJT1C coefficients are used in calculating the equivalent temperature difference mentioned in PP3 above [Appendix G]. PP4 applies only to hermetic centrifugal vapor-compression chillers.

PP5 Same as PP3, but for open centrifugal vapor-compression chillers.

PP6 Same as PP4, but for open centrifugal vapor-compression chillers.

PP7 Same as PP3, but for reciprocating vapor-compression chillers.

PP8 Same as PP4, but for reciprocating vapor-compression chillers.

PP9 Same as PP3, but for double-bundle vapor-compression chillers.

PP10 Same as PP4, but for double-bundle vapor-compression chillers.

PP11 Same as PP3, but for heat pump.

PP12 Same as PP4, but for heat pump.

PP13 CPUMP are the chilled water pump power coefficients [Appendix G].

PP14-20 These coefficients represent the performance of cooling towers. Omit if no cooling tower is specified on CP9 card, or if defaults are acceptable [Appendix G].

PP21 TPUMP are the cooling tower water pump power coefficients [Appendix G].

PP22 Ends specification of central plant equipment off-design performance curves. Omit if others follow.

CP14 Ends description of central plant begun with preceding CP2 card. Omit if other data for this central plant follow.

CP15 Ends the description of all central plants begun by CP1 card. Omit if more central plant data or CP2 cards follow.

RC9 Last card in BLAST input deck. Omit if input of any kind follows.

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO.

```
Y  PP1   ..  OFF-DESIGN CURVES
Y  PP1       EQUIPMENT PERFORMANCE PARAMETERS:
   C     ..  BOILERS
   PP2          RFUELB  ( , , ); HPUMP ( , , );
   C     ..  CHILLERS/HEAT PUMPS
   PP3          RPWR1C  ( , , ); RCAV1C ( , , );
   PP4          ADJT1C  ( , , ); ADJE1C ( , , );
   PP5          RPWR2C  ( , , ); RCAV2C ( , , );
   PP6          ADJT2C  ( , , ); ADJE2C ( , , );
   PP7          RPWR3C  ( , , ); RCAV3C ( , , );
   PP8          ADJT3C  ( , , ); ADJE3C ( , , );
   PP9          RPWRDB  ( , , ); RCAVDB ( , , );
   PP10         ADJTDB  ( , , ); ADJEDB ( , , );
   PP11         RPWRHP  ( , , ); RCAVHP ( , , );
   PP12         ADJTHP  ( , , ); ADJEHP ( , , );
   PP13         CPUMP   ( , , );
   C     ..  COOLING TOWERS
   PP14         RF1     ( , , );
   PP15         RF2     ( , , );
   PP16         RF3     ( , , );
   PP17         RF4     ( , , );
   PP18         RF5     ( , , );
   PP19         RF6     ( , , );
   PP20         RFR     ( , , );
   PP21         TPUMP   ( , , );
   PP22      END EQUIPMENT PERFORMANCE PARAMETERS:
   CP14    END PLANT;
Y  CP16  END CENTRAL PLANT DESCRIPTION:
Y  RC0   END INPUT;
```

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT MOST COLUMN. 2. CHARACTER SET (029/EBCDIC,026/BCD) 3. CONVENTIONS 1,Φ,S (ALPHA) : " (SPECIAL) 1,Φ,5 (NUMERIC)

BLAST INPUT FORM 22
Central plant off design performance curves
Boilers, vapor compression machines and their cooling towers

BLAST Input Form 23: Equipment Performance Parameters for Boilers, Absorption Chillers, Cooling Towers, and Solar Collectors

PP1 Begins specification of central plant equipment off-design performance curves.

PP2 RFUELB coefficients represent the actual to theoretical boiler efficiency ratio vs part-load ratio. HPUMP are the heating pump power coefficients [Appendix G].

PP23 The REN1A coefficients represent the ratio of required input heat energy per unit time to the cooling load vs part-load ratio for single-stage absorption chillers [Appendix G].

PP24 Same as PP23, but for two-stage absorption chiller.

PP25 Same as PP23, but for two-stage absorption chiller with an economizer.

PP13 CPUMP are the chilled water pump power coefficients [Appendix G].

PP14-20 These coefficients represent the performance of cooling towers. Omit if no cooling tower is specified on CP9 card, or if defaults are acceptable [Appendix G].

PP21 TPUMP are the cooling tower water pump power coefficients [Appendix G].

PP27 SOLAR coefficients represent collector efficiency vs ΔT/Incident solar radiation.

PP22 Ends specification of central plant equipment off-design performance curves. Omit if others follow.

CP14 Ends description of central plant begun with preceding CP2 card. Omit if other data for this central plant follow.

CP15 Ends the description of all central plants begun by CP1 card. Omit if more central plant data or CP2 cards follow.

RC9 Last card in BLAST input deck. Omit if input of any kind follows.

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO.

```
                OFF-DESIGN CURVES
Y               EQUIPMENT PERFORMANCE PARAMETERS:
                BOILERS
                  RFUELB (     ,     ,     ); HPUMP  (     ,     ,     );
                ABSORPTION CHILLERS
                  REN1A  (     ,     ,     );
                  REN2A  (     ,     ,     );
                  REN2AE (     ,     ,     );
                  CPUMP  (     ,     ,     );
                COOLING TOWERS
                  RF1    (     ,     ,     );
                  RF2    (     ,     ,     );
                  RF3    (     ,     ,     );
                  RF4    (     ,     ,     );
                  RF5    (     ,     ,     );
                  RF6    (     ,     ,     );
                  RFR    (     ,     ,     );
                  TPUMP  (     ,     ,     );
                SOLAR COLLECTORS
                  SOLAR  (     ,     ,     );
Y               END EQUIPMENT PERFORMANCE PARAMETERS;
              END PLANT;
Y           END CENTRAL PLANT DESCRIPTION;
Y           END INPUT;
```

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (029/EBCDIC,026/BCD) 3. CONVENTIONS 1,4,5 (ALPHA) ; " (SPECIAL) 1,0,5 (NUMERIC)

BLAST INPUT FORM 23

Central plant off-design performance curves Boiler, absorption chillers and their cooling towers, solar collectors

BLAST Input Form 24: Equipment Performance Parameters for Engine Generators

PP1 Begins specification of central plant equipment off-design performance curves.

PP28 The FUEL1G coefficients represent gas turbine energy input variations vs part-load ratio. FUEL2G represents a correction of ambient temperature from 77°F (25°C). [Appendix G]

PP29 The FEXG coefficients represent the variation of gas turbine exhaust flow rate vs the departure of ambient temperature from 77°F (25°C) [Appendix G].

PP30 The TEX1G and TEX2G coefficients represent variation of gas turbine exhaust temperature vs part-load ratio, and the departure of ambient temperature from 77°F (25°C), respectively. [Appendix G].

PP31 Use this card to control waste heat generation from gas turbines. ELUBG coefficients represent the variation of recoverable lube oil waste heat with part-load ratio. UACG represents the variation of the overall heat transfer coefficient-area product with part-load ratio. If waste heat is not to be recovered, set all ELUBG coefficients and UACG to zero [Appendix G].

PP32 The RELD coefficients represent the variation of diesel electrical power output per unit fuel consumed with part-load ratio. RJACD coefficients represent jacket recoverable heat vs part-load ratio. Set RJACD to zero if no jacket heat is to be recovered [Appendix G].

PP33 REXD coefficients represent total exhaust heat variations with part-load ratio for diesel generator set. TEXD represents diesel exhaust gas temperature vs part-load ratio. If no exhaust heat recovery, set all REXD coefficients to zero.

PP34 Same as PP31, but applies to diesel generator sets.

PP22 Ends specification of central plant equipment off-design performance curves. Omit if others follow.

CP14 Ends description of central plant begun with preceding CP2 card. Omit if other data for this central plant follow.

CP15 Ends the description of all central plants begun by CP1 card. Omit if more central plant data or CP2 cards follow.

RC9 Last card in BLAST input deck. Omit if input of any kind follows.

ORGANIZATION ______ PROJECT NAME ______ DATE ______ ANALYST ______ PROJECT NO. ______

```
Y  C     OFF-DESIGN CURVES
Y  PP1   EQUIPMENT PERFORMANCE PARAMETERS:
   C     GAS TURBINE GENERATOR SETS
   PP28     FUEL1G  (     ,     ,     );  FUEL2G  (     ,     ,     );
   PP29     FEXG    (     ,     ,     );
   PP30     TEX1G   (     ,     ,     );  TEX2G   (     ,     ,     );
   PP31     ELUBG   (     ,     ,     );  UACG    (     ,     ,     );
   C     DIESEL GENERATOR SETS
   PP30     RELD    (     ,     ,     );  RJACD   (     ,     ,     );
   PP33     REXD    (     ,     ,     );  TEXD    (     ,     ,     );
   PP34     RLUBD   (     ,     ,     );  UACD    (     ,     ,     );
Y  P22   END EQUIPMENT PERFORMANCE PARAMETERS;
   CP14  END PLANT;
Y  CP15  END CENTRAL PLANT DESCRIPTION;
Y  RC2   END INPUT;
```

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT MOST COLUMN. 2. CHARACTER SET ______ (029/EBCDIC,026/BCD) 3. CONVENTIONS 1,0,5 (ALPHA) : " (SPECIAL) 1,0,5 (NUMERIC)

BLAST INPUT FORM 24

Central plant off design performance curves

Total energy systems – generation equipment

Economic Data Input

BLAST Input Forms 25 and 26 can be used to do an accurate life-cycle cost analysis for the building and its energy system. These forms allow specification of basic economic factors, energy costs, and equipment costs. If the user is interested in energy only, the user should accept the default values on all economic factors and costs and omit these forms. In this case, the economic analysis performed by BLAST probably should not be relied upon since actual cost data are known to vary widely with time and location. Note: certain items can be specified while accepting defaults on others.

Input Form 25: Life-Cycle Cost Parameters and Energy Cost Data

LC1 Begins specification of life-cycle cost parameter. Omit this and all other LC cards if defaults are acceptable.

LC2 Enter the applicable interest rate (cost of capital) as a percent, and the project life in years. For mid-year payment time for annual and periodic costs, PAYMENT TIME = 0.5; for end-of-year payments, PAYMENT TIME = 1.0.

LC3 The cost of maintenance labor will be escalated annually by the percentage indicated here.

LC4 The cost of supplies other than fuel will be escalated annually by the percentage indicated here.

LC5 The hourly cost of maintenance labor in dollars should be entered here.

LC6 The ADJUSTMENT FACTOR will be used as a multiplier on all costs *except initial costs.* This card can be used for adjustment on future costs, including fuel and energy to bring all life-cycle values back to the midpoint of construction.

LC7 Ends life cycle cost parameters.

LC8 Begins specification of energy cost information for one or more categories of energy. This card can be omitted if defaults are acceptable; however, accurate life-cycle cost results usually require these data for local utilities.

LC9 Select one of the following fuel or energy types: ELECTRICITY, BOILER FUEL, GAS TURBINE FUEL, DIESEL FUEL. Close data input for this fuel type with a semicolon after the last entry.

LC10 If ENGLISH units (see card type RC8), ENERGY UNITS should be set to the number of kBtu per unit of the energy type indicated on LC9. For example, if ELECTRICITY, ENERGY UNITS = 3.412. The UNIT COST = 0.05 indicates a uniform energy cost of $0.05 per kWh. If BLOCKS statement is used (LC15), only the sign of UNIT COST is used by BLAST [Chapter 6].

LC11 This card can be used to override the BLAST life-cycle cost method which uses a uniform interest and inflation rate. If inflation or interest is nonuniform, set COST ESCALATION FACTOR equal to the series present worth factor $(P/A, i, n)$. Then life-cycle fuel costs will be calculated as the first year cost times this factor.

LC12 Enter the minimum monthly utility charge (in dollars) for this energy type.

LC13 Enter the minimum, peak, hourly demand (energy units/hr) as specified by the utility. See LC14 instruction.

LC14 DEMAND CHARGE will be multiplied by the larger of MINIMUM PEAK DEMAND and actual peak demand and the product added to every unit of energy consumed during the month. Actual peak demand is determined monthly by BLAST.

LC15.1, 15.2 Use these cards to indicate energy costs that vary with amount used. Two types of usage blocks are allowed: fixed and adjusted by peak. For fixed block sizes, set UNIT COST = −1 on LC10. Then enter block sizes (energy units) and applicable cost ($/energy unit) in the parentheses for as many as 10 blocks. For variable blocks, set UNIT COST = 1 on LC10. Then the first number within each parentheses pair will be multiplied by actual hourly peak for the month to set the block size. See Users Manual [Chapter 6] for examples.

LC16 Ends ENERGY COST data. Must be placed after the last energy type that has been described.

CP14 Ends description of central plant begun with preceding CP2 card. Omit if other data for this central plant follow.

CP15 Ends the description of all central plants begun by CP1 card. Omit if more central plant data or CP2 cards follow.

RC9 Last card in BLAST input deck. Omit if input of any kind follows.

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO.

```
    C     ..  LIFE CYCLE COST DATA
    LC1       LIFE CYCLE COST PARAMETERS:
Y   LC2          INTEREST RATE= ;    PROJECT LIFE=     ;    PAYMENT TIME=     ;
    LC2          LABOR INFLATION=       ;
    LC4          SUPPLIES INFLATION=    ;
    LC5          UNIT LABOR COST =      ;
    LC6          ADJUSTMENT FACTOR=     ;
    LC7       END LIFE CYCLE COST PARAMETERS;
    C     ..  ENERGY COST DATA
Y   LC8       ENERGY COST:
    LC9
Y   LC10           ENERGY UNIT=          , UNIT COST=          ,
Y   LC11           COST ESCALATION FACTOR=     ,
    LC12           MINIMUM MONTHLY CHARGE=        ;
    LC13           MINIMUM PEAK LOAD=       ,
    LC14           DEMAND CHARGE=       ,
    LC15.1         BLOCKS=(    ,    ) (    ,    )
    LC15.2                (    ,    ) (    ,    )                ;
    LC9
    LC10           ENEGY UNIT=           , UNIT COST=          ,
    LC11           COST ESCALATION FACTOR=     ,
    LC12           MINIMUM MONTHLY CHARGE=     ,
    LC13           MINIMUM PEAK LOAD=      ,
    LC14           DEMAND CHARGE=       ,
    LC15.1         BLOCKS=(    ,    ) (    ,    )
    LC15.2                (    ,    ) (    ,    )                ;
Y   LC16      END ENERGY COST;
    CP14    END PLANT;
Y   CP19  END CENTRAL PLANT DESCRIPTIONS;
Y   RC9   END INPUT;
```

KEYPUNCH INSTRUCTIONS 1. PUNCH ALL LINES WHICH HAVE X IN LEFT MOST COLUMN. 2. CHARACTER SET (029/EBCDIC,026/BCD) 3. CONVENTIONS 1,I,S (ALPHA) (SPECIAL) 1,0,5 (NUMERIC)

BLAST INPUT FORM 25

Economic data – life cycle cost and energy cost

PAGE 65 BLANK

BLAST Input Form 26: Equipment Cost Data

EC1 Can be used to begin either REFERENCE or ACTUAL EQUIPMENT COST data block. Use ACTUAL if costs are available for equipment indicated on CP9 cards. Use REFERENCE to override default reference cost data. Omit if costs scaled from default reference cost tables are acceptable.

EC2 Enter the BLAST name for equipment considered. If EC1 specified ACTUAL, EC2–8 cards should be repeated for each type *and* size if equipment is selected on CP9 cards. For REFERENCE, only one for each type is allowed. End parameter entry for each EC2 card with a semicolon.

EC3 Enter SIZE (kBtu or kWh), COST ($), and LIFE (hr) for the equipment listed on previous EC2 card.

EC4 Enter the ratio of total installed cost to the cost of equipment alone.

EC5 Enter the cost ($/hr) of consumable materials other than fuel or energy.

EC6 Enter the annual maintenance hours (hr/year).

EC7 Enter the operating hours between minor overhauls, and the cost ($) for such overhauls.

EC8 Enter the operating hours between major overhauls, and the cost ($) for such overhauls.

EC9 Ends entry of REFERENCE or ACTUAL EQUIPMENT COST data.

CP14 Ends description of central plant begun with preceding CP2 card. Omit if other data for this central plant follow.

CP15 Ends the description of all central plants begun by CP1 card. Omit if more central plant data or CP2 cards follow.

RC9 Last card in BLAST input deck. Omit if input of any kind follows.

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO.

```
  ••   REFERENCE/ACTUAL EQUIPMENT COSTS
Y              EQUIPMENT COST:
Y
           SIZE=          ,      COST=          ,     LIFE=      ,
           INSTALLATION COST FACTOR=            ,
           CONSUMABLES=    ,
           MAINTENANCE=         ,
           HOURS TO MINOR OVERHAUL=          ,  MINOR OVERHAUL COST=        ,
           HOURS TO MAJOR OVERHAUL=          ,  MAJOR OVERHAUL COST=        ;

           SIZE=          ,      COST=          ,     LIFE=      ,
           INSTALLATION COST FACTOR=            ,
           CONSUMABLES=    ,
           MAINTENANCE=         ,
           HOURS TO MINOR OVERHAUL=          ,  MINOR OVERHAUL COST=        ,
           HOURS TO MAJOR OVERHAUL=          ,  MAJOR OVERHAUL COST=        ;

           SIZE=          ,      COST=          ,     LIFE=      .
           INSTALLATION COST FACTOR=            ,
           CONSUMABLES=    ,
           MAINTENANCE=         ,
           HOURS TO MINOR OVERHAUL=          ,  MINOR OVERHAUL COST=        ,
           HOURS TO MAJOR OVERHAUL=          ,  MAJOR OVERHAUL COST=        ;
Y      END             EQUIPMENT COST;
     END PLANT;
Y  END CENTRAL PLANT DESCRIPTION;
Y END INPUT;
```

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT MOST COLUMN. 2. CHARACTER SET (029/EBCDIC 026/BCD) 3. CONVENTIONS 1,I,S (ALPHA) : " (SPECIAL) 1,0,5 (NUMERIC)

BLAST INPUT FORM 26

Economic data – equipment costs

BLAST Input Form 27: Building and Fan System Cost Data

BC1 Begins specification of cost data for building and fan system. Omit BC1-BC8 if these costs are not to be included in the life-cycle cost.

BC2 Enter building initial costs ($) exclusive of central plant and fan system equipment.

BC3 Enter annual building maintenance costs ($/year). Will be escalated by LABOR INFLATION given on EC3.

BC4 Enter any periodic building costs ($) (e.g., painting and other refurbishings) along with the number of years between these costs. Do not include costs to be accounted for elsewhere, e.g., equipment replacement.

BC5 Enter fan system initial cost ($).

BC6 Enter annual fan system maintenance costs ($/year). Will be escalated by LABOR INFLATION given on EC3.

BC7 Enter periodic Fan System costs ($) (e.g., motor and controls replacement, etc.) along with the number of years between these costs.

BC8 Ends specification of building and fan system cost data.

CP14 Ends description of central plant begun with preceding CP2 card. Omit if other data for this central plant follow.

CP15 Ends the description of all central plants begun by CP1 card. Omit if more central plant data or CP2 cards follow.

RC9 Last card in BLAST input deck. Omit if input of any kind follows.

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO.

```
C     ..   BUILDING AND FAN SYSTEM COSTS
Y BC1      OTHER COST PARAMETERS:
  BC2          BUILDING CAPITAL COST = ________;
  BC3          ANNUAL BUILDING MAINTENANCE = ________;
  BC4          PERIODIC BUILDING COSTS = ________, PERIOD = ________;
  BC5          FAN SYSTEM CAPITAL COST = ________;
  BC6          ANNUAL FAN SYSTEM MAINTENANCE = ________;
  BC7          PERIODIC FAN SYSTEM COSTS = ________, PERIOD = ________;
Y BC8      END OTHER COST PARAMETERS;
  CP14   END PLANT;
  CP15  END CENTRAL PLANT DESCRIPTION;
  BC4  END INPUT;
```

OPTIONAL SEQUENCE NO.

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET ________ (029/EBCDIC,026/BCD) 3. CONVENTIONS 1,I,S (ALPHA) : " (SPECIAL) 1,0,5 (NUMERIC)

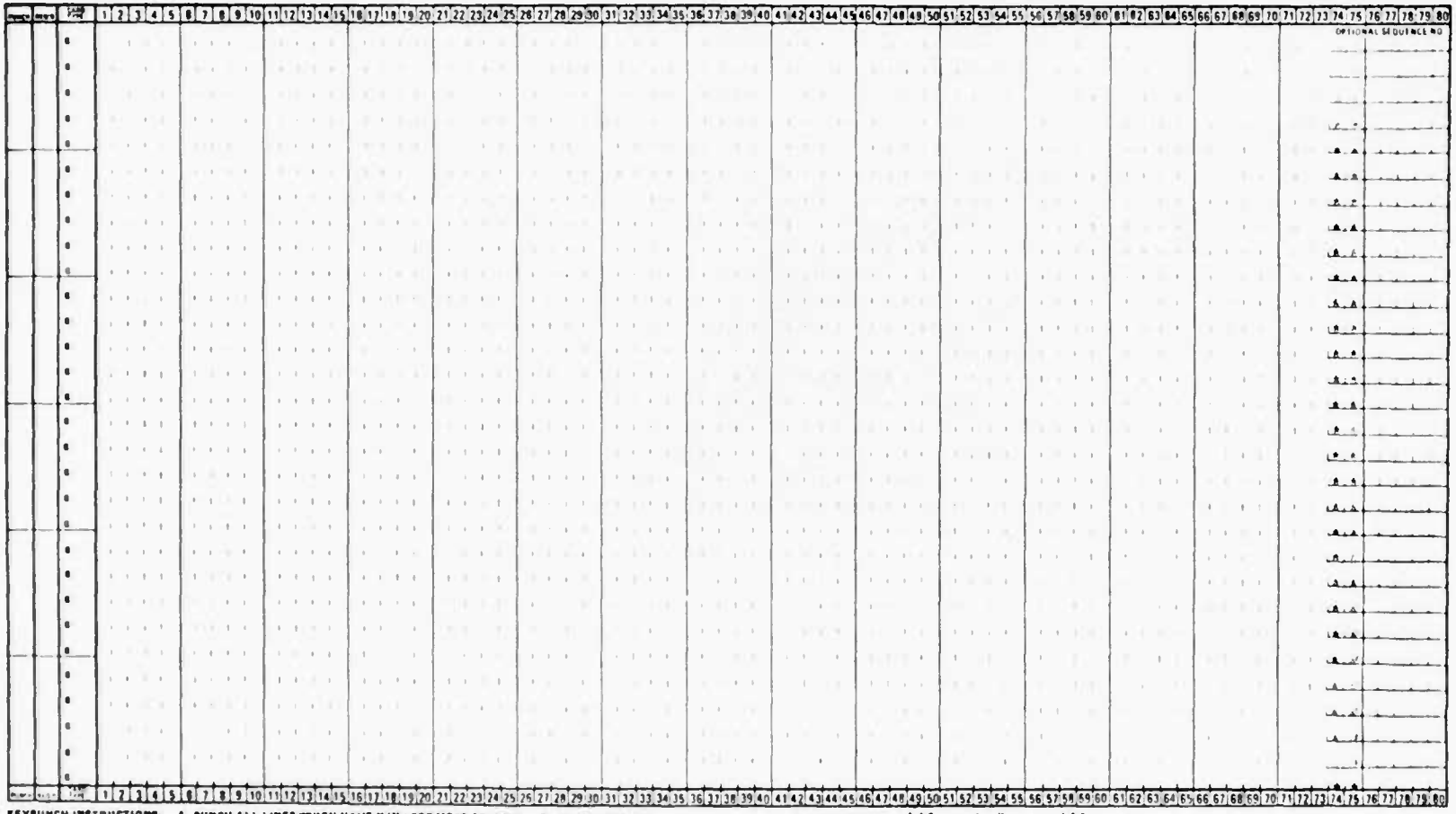
BLAST INPUT FORM 27

Building and fan system costs

BLAST Input Form 28: General

This general coding sheet allows insertion of special input allowed by BLAST that is used too infrequently to be part of other input forms. It can also be used as a continuation form if more entries than other forms allow are desired.

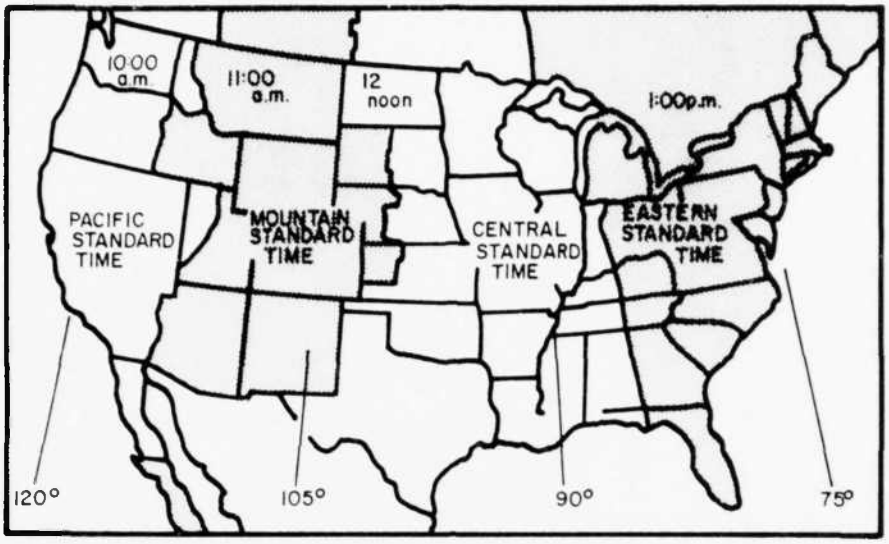
ORGANIZATION _____ PROJECT NAME _____ DATE _____ ANALYST _____ PROJECT NO. _____



KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT MOST COLUMN. 2. CHARACTER SET (026/EBCDIC,026/BCD) 3. CONVENTIONS A⇧S (ALPHA) : " (SPECIAL) 1,8,8 (NUMERIC)

BLAST INPUT FORM 28

General free form input for any BLAST statement



TIME ZONE NUMBERS IN U.S. FOR STANDARD TIME

TIME ZONE	TZN
ATLANTIC	4
EASTERN	5
CENTRAL	6
MOUNTAIN	7
PACIFIC	8

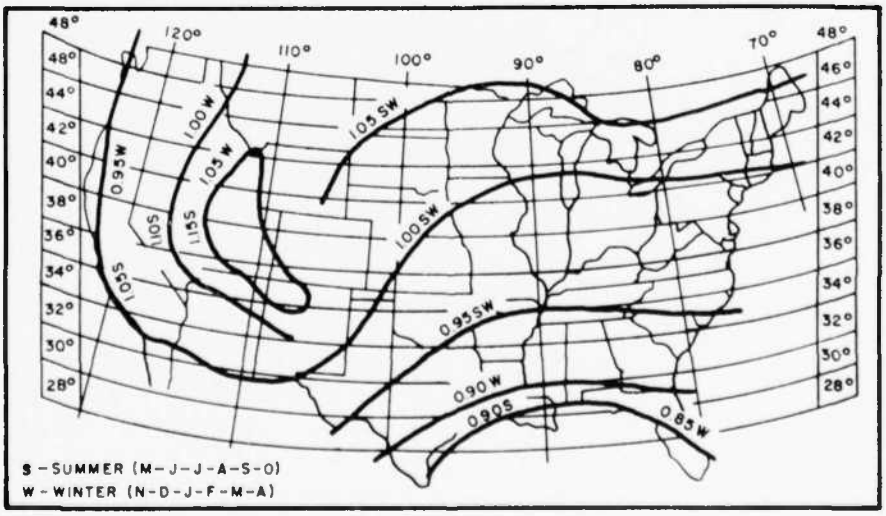


Figure 4. Time zone and clearness number data.

Table 5
Other System Parameters Applicability

Other System Parameters Applicability

- INDICATES PARAMETER MAY AFFECT SYSTEM

	MULTIZONE	DUAL DUCT (2)	DUAL DUCT VARIABLE VOLUME	THREE DECK MULTIZONE	VARIABLE VOLUME	TERMINAL REHEAT (1)	SUBZONE REHEAT (1)	TWO PIPE FAN COIL (1)	FOUR PIPE FAN COIL (1)	SINGLE ZONE DRAW THRU	DX PACKAGED UNIT	UNIT VENTILATOR
SUPPLY FAN PRESSURE & EFFICIENCY	•	•	•	•	•	•	•	•	•	•	•	•
RETURN FAN PRESSURE & EFFICIENCY	•	•	•	•	•	•	•			•	•	•
EXHAUST FAN PRESSURE & EFFICIENCY	•	•	•	•	•	•	•	•	•	•		•
COLD DECK CONTROL/TEMPERATURE	•	•	•	•	•	•	•	•	•	•		
COLD DECK THROTTLING RANGE	•	•	•	•	•	•	•			•		
COLD DECK CONTROL SCHEDULE	•	•	•	•	•	•	•			•		
HEATING COIL ENERGY/CAPACITY	•	•	•	•				•	•	•	•	•
HOT DECK CONTROL/TEMPERATURE	•	•	•	•	•	•	•	•	•	•	•	•
HOT DECK THROTTLING RANGE	•	•	•	•						•		•
HOT DECK CONTROL SCHEDULE	•	•	•	•	•	•	•	•	•	•	•	•
MIXED AIR CONTROL	•	•	•	•	•	•	•			•	•	•
DESIRED MIXED AIR TEMPERATURE	•	•	•	•	•	•	•			•	•	•
OUTSIDE AIR VOLUME	•	•	•	•	•	•	•			•	•	•
WEEKDAY MINIMUM OUTSIDE AIR SCHEDULE	•	•	•	•	•	•	•	•	•	•	•	•
WEEKDAY MAXIMUM OUTSIDE AIR SCHEDULE	•	•	•	•	•	•	•			•	•	•
WEEKEND MINIMUM OUTSIDE AIR SCHEDULE	•	•	•	•	•	•	•	•	•	•	•	•
WEEKEND MAXIMUM OUTSIDE AIR SCHEDULE	•	•	•	•	•	•	•			•	•	•
PREHEAT COIL LOCATION	•	•	•	•	•	•	•			•		•
PREHEAT AT TEMPERATURE	•	•	•	•	•	•	•			•		•
PREHEAT ENERGY/CAPACITY	•	•	•	•	•	•	•			•		•
GAS BURNER EFFICIENCY	•	•	•	•	•	•	•		•	•	•	•
VAV MINIMUM AIR FRACTION			•		•							
VAV VOLUME CONTROL			•		•							
FAN POWER COEFFICIENTS			•		•							
HUMIDIFIER TYPE	•	•	•	•	•	•	•			•		•
HUMIDISTAT LOCATION	•	•	•	•	•	•	•			•		•
HUMIDISTAT SET POINT	•	•	•	•	•	•	•			•		•

NOTES:
1. HOT DECK TEMPERATURE SETS UPPER LIMIT ON REHEAT OR HEATING COIL TEMP.
2. DUAL DUCT IS THE SAME AS MULTIZONE IN BLAST; MULTIZONE IS THE RECONIZED NAME.

Table 6
Applicability of Cooling Coil Design Parameters

Cooling Coil Design Parameters Applicability

● INDICATES PARAMETER AFFECTS SYSTEM

	PACKAGED DX COILS	DIRECT EXPANSION COILS	WATER COILS IN FAN COIL UNITS	ALL OTHER CILLED WATER COILS
COIL TYPE		●		●
AIR VOLUME FLOW RATE		●	●	●
BAROMETRIC PRESSURE		●	●	●
AIR FACE VELOCITY		●		●
ENTERING AIR DRY BULB TEMPERATURE		●	●	●
ENTERING AIR WET BULB TEMPERATURE		●	●	●
LEAVING AIR DRY BULB TEMPERATURE		●	●	●
LEAVING AIR WET BULB TEMPERATURE		●		●
ENTERING WATER TEMPERATURE			●	●
LEAVING WATER TEMPERATURE			●	●
WATER VOLUME FLOW RATE			●	●
WATER VELOCITY				●
ENTERING REFRIGERANT TEMPERATURE		●		
LEAVING REFRIGERANT TEMPERATURE		●		
TOTAL COOLING LOAD		●		
NUMBER OF TUBE CIRCUITS		●		
DXCOIL1	●			
DXCOIL2	●			
DXCOIL3	●			

PERFORMANCE COEFFICIENTS FOR PACKAGE DX UNITS

Table 8
Special Parameters Applicability

Special parameters employed for each equipment type

Special Parameter Name	Special Parameter Description	GAS TURBINE	DIESEL GENERATOR	BOILER	ONE STAGE ABSORBER	TWO STAGE ABSORBER	TWO STAGE ABSORBER W ECON	CHILLER	OPEN CHILLER	RECEPROCATING CHILLER	DOUBLE BUNDLE CHILLER	COOLING TOWER	CERAMIC COOLING TOWER	SOLAR COLLECTORS	STEAM TURBINE	HOT STORAGE TANK	COLD STORAGE TANK	HEAT PUMP	PUMPS
AZMUTH	Collector Array Azimuth Angle													•					
FLOWRT	Mass Flow/Collector Area													•					
HFUELB	Heat Content of Fuel			•															
HTXEFF	Tank Collector Ht Excgr Effectiveness													•					
MXTNKT	Maximum Solar Tank Temp													•					
PELCL	Elect Inp to Circ Pump/Cooling Load																		•
PELHT	Elect Inp to Circ Pump/Heating Load																		•
PELTWR	Elect Inp to Tower/Tower Cool Load				•	•	•	•	•	•	•	•	•						•
PSTEAM	Steam Pressure	•	•	•	•	•	•												
PSTMTUR	Entering Steam Press														•				
RAVRHDB	Availbl Recvrbl Ht Ratio										•								
RAVRHHP	Availbl Recvrbl Ht Ratio																	•	
RFLASH	Boiler Flash Water/Steam Feed			•															
RHFLASH	Recovd Heat/Flash Steam Energy			•															
RMXKWD	Max Exh Flow/KW Output		•																
RMXKWG	Max Exh Flow/KW Output	•																	
RPMNOM	Nom Speed, RPM														•				
RWCA	Tower Water/Absor Chlr Capac				•	•	•					•	•						
RWCC	Tower Water/Compr Chlr Capac							•	•	•		•	•						
RWCDB	Tower Water/Dbund Chlr Capac										•	•	•						
RWCHP	Tower Water/Ht Pump Capac											•	•					•	
RWSTUR	Condensate/Entering Steam														•				
SRATB	Air, Fuel Stoich Ratio			•															
STEAM	Steam Enthalpy	•	•	•	•	•	•												
TNKTEM	Initial Tank Temperature													•					
TCOOL	Chilled Water Temp							•	•	•	•							•	
TCW	Leaving Condenser Water Temp										•								
TILT	Solar Collector Tilt Angle													•					
TLEAVE	Boiler Stack Leaving Temp			•															
TMINC	Min Tank Temp for Cooling				•									•					
TMINH	Min Tank Temp for Heating													•					
TMINHP	Min Tank Temp for Ht Pump													•				•	
TNKCAP	Storage Tank Cap/Col. Area													•					
TOTUEF	Tot Effic of Util Elec Generation	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
TOWOPR	Tower Operation Type											•	•						
TSATUR	Steam Saturation Temp	•	•	•	•	•	•												
TSTMTUR	Entering Steam Temp														•				
TTOWR	Minimum Leaving Tower Water Temp				•	•	•	•	•	•	•	•	•					•	
TWMAKE	Make Up Water Temp			•															

5 EXAMPLE OF USING INPUT FORMS

The building in the example described in this chapter is a small laboratory at Tyndall Air Force Base (AFB). It must be recognized, however, that no single example will include all possible variations in BLAST input; some of the input forms described in Chapter 4 were not used.

The laboratory at Tyndall AFB is a single-story structure of concrete block, slab-on-grade construction. Gross floor space is 9882 sq ft (918 m^2). A simplified floor plan of the building and its elevations are shown in Figure 7. Actual construction details were extracted from the as-built drawings.

The BLAST model of this building has four simulation zones, served by a single, MULTIZONE fan system. The envelope has a single exterior wall type, with an 8-in. (0.64 m), heavy-weight concrete block layer selected from the BLAST library. It is coated inside and outside with a user-defined stucco material layer. A roof-ceiling combination with an air space is described using library materials. The slab floor is defined by a 6 in. (.15 m) concrete layer plus 12 in. (.30 m) of dirt. Both material layers are referenced from the standard BLAST library. These descriptions may be seen on Forms 2 and 4.

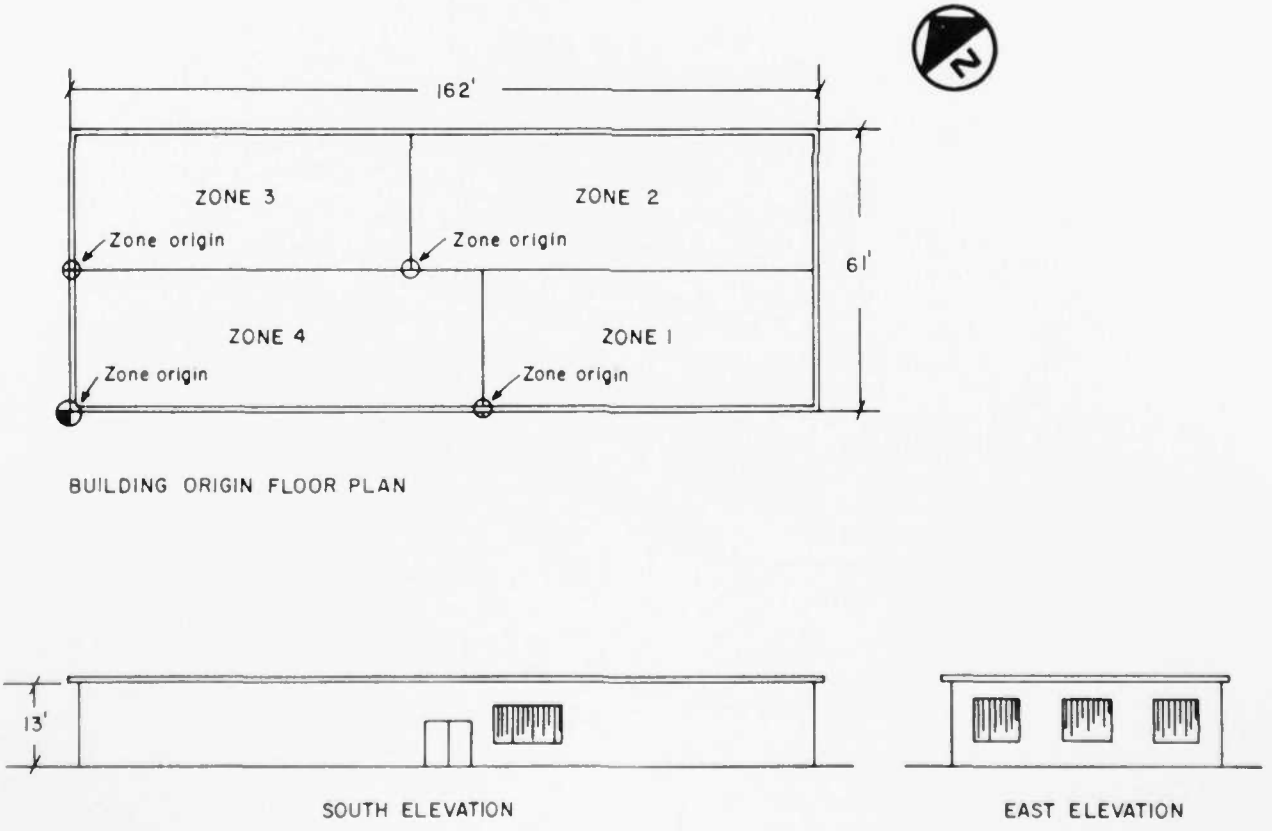


Figure 7. Floor plan, elevations, zone boundaries and selected zone origins for laboratory building Tyndall AFB.

Infiltration and office equipment schedules are user defined (see Form 5). Other schedules are taken from the standard BLAST library.

In the description of the building (Form 7), the BLAST DIMENSION statement is used to define wall and window height and the building directions (north, east, south, and west) with convenient variable names. The NORTH AXIS command is used to establish the building north as 36 degrees east of north.

The building is divided into four simulation zones which correspond exactly to the physical zoning. Figure 7 shows the zone boundaries and the selected zone origins. In this example, the zone axes have been aligned with the building axes. The rectangular dimensions of the zone were assigned to the variable names A and B using the DIMENSION statement within the zone description block (see Form 9). This allows the walls, floors, and roof of the zone to be defined by the symbols A, B, and H4 (Form 10) as recommended for the BLAST Geometric Zone Form.

A single MULTIZONE fan system is used to serve all four zones (Form 11). Supply and exhaust air volumes were taken from available mechanical data. Forms 12, 13, and 14 establish fan pressures and efficiencies, specify the system control characteristics, and to define the DX coils and condensing unit. System schedules are defined on Form 15.

The central plant, described on Form 16, is simply a boiler which supplies domestic hot water and the heating coils. The cooling coils are served by the DX condensing unit which is treated by BLAST as part of the fan system. Form 19 is used to set the PELHT parameter, which establishes the electrical power used for hot water pumps.

This example should be input and run by the user. Its simplicity minimizes the effort and the chances of error. Computer costs will be modest since the RUN CONTROL block calls for only two design days to be run.

ORGANIZATION ____ PROJECT NAME ____ DATE ____ ANALYST ____ PROJECT NO. 1/27

Punch		Card type	Statement
		C	** RUN CONTROL BLOCK
X	Y	RC1	BEGIN INPUT;
X	Y	RC2	RUN CONTROL:
X		RC3	NEW ZONES,
X		RC4	NEW AIR SYSTEMS,
X		RC5	CENTRAL PLANT,
		RC6	PRINT LIBRARY,
X		RC7	REPORTS (WALLS, ZONE, SYSTEM);
		RC8	UNITS (IN= , OUT=);
		C	** LIBRARY MODIFICATION BLOCK
X		DL1	DEFINE LOCATION: TYNDALL AFB =(LAT=30 , LONG=85 , TZ=6);
X		DL2	END;
X	Y	DD1	DEFINE DESIGN DAYS:
X	Y	DD2.1	TYNDALL AFB SUMMER =(HIGH=92 , LOW=78 , WB=81 , WS=616,
X	Y	DD2.2	DIR=225 , DATE=21 JUL , PRES=405 , CLEARNESS=0.9 ,
X	Y	DD2.3	WEEKDAY, CLEAR),
X	Y	DD2.1	TYNDALL AFB WINTER =(HIGH=50 , LOW=32 , WB=46 , WS=616,
X		DD2.2	DIR=180 , DATE=21 JAN , PRES=405 , CLEARNESS=0.95,
X		DD2.3	WEEKEND, RAIN);
		DD2.1	=(HIGH= , LOW= , WB= , WS=
		DD2.2	DIR= , DATE= , PRES= , CLEARNESS=
		DD2.3	),
		DD2.1	=(HIGH= , LOW= , WB= , WS=
		DD2.2	DIR= , DATE= , PRES= , CLEARNESS=
		DD2.3	),
X		DD3	END DESIGN DAYS;

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (026/EBCDIC,026/BCD) 3. CONVENTIONS 1,Ø,S (ALPHA) : - (SPECIAL) 1,0,5 (NUMERIC)

BLAST INPUT FORM 1

Run control

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO. 2/27

```
X Y  ..      LIBRARY MODIFICATION BLOCK - OPAQUE MATERIAL DEFINITIONS
X Y  DEFINE  MATERIALS:
X            =(L=.0521,K=.416,CP=0.2,D=116,ABS=0.73
               ,TABS=0.9,VERY ROUGH   );
  Y          =(L=    ,K=    ,CP=    ,D=    ,ABS=
               ,TABS=    ,        );
  Y          =(L=    ,K=    ,CP=    ,D=    ,ABS=
               ,TABS=    ,        );
  Y          =(L=    ,K=    ,CP=    ,D=    ,ABS=
               ,TABS=    ,        );
  Y          =(L=    ,K=    ,CP=    ,D=    ,ABS=
               ,TABS=    ,        );
  Y          =(L=    ,K=    ,CP=    ,D=    ,ABS=
               ,TABS=    ,        );
  Y          =(L=    ,K=    ,CP=    ,D=    ,ABS=
               ,TABS=    ,        );
  Y          =(L=    ,K=    ,CP=    ,D=    ,ABS=
               ,TABS=    ,        );
     ..      LOW THERMAL MASS MATERIALS
  Y          =(R=    ,ABS=                      );
  Y          =(R=    ,ABS=                      );
  Y          =(R=    ,ABS=                      );
  Y          =(R=    ,ABS=                      );
     ..      GENERAL MATERIALS
  Y          =(
                                                );
  Y          =(
                                                );
X Y  END MATERIALS;
```

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (029/EBCDIC,026/BCD) 3. CONVENTIONS 1,0,S (ALPHA) : " (SPECIAL) 1,0,5 (NUMERIC)

BLAST INPUT FORM 2

Definition of opaque materials

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO. 3/27

```
X Y  ••         LIBRARY MODIFICATION BLOCK - CONSTRUCTION ELEMENTS
X Y  DEFINE WALLS  :
X Y    EXT WALL              =(STCØ,C8-8 IN HW CØNCRETE BLØCK,STCØ;
                                                                 );
X Y  END WALLS ;
X Y  DEFINE FLØORS :
X Y    SLAB                  =(DIRT 12 IN,C13-6 IN HW CONCRETE);
                                                                 );
X Y  END FLOORS ;
X Y  DEFINE ROOFS :
X Y    RF                    =(ROOFING-BUILT UP RØØFING-3/8 IN,INSULATIØN
X                            -INSULATING RØØF DECK 2 IN,BUILDING BØARD-
X                            PLYWØØD 1/2 IN,BUILDING BØARD-GYPSUM PLASTER
X                            1/2 IN,AIRSPACE-HØRIZØNTAL DØWN,BUILDING
X Y                          BØARD-ACOUSTIC TILE 1/2 IN              );
X Y  END ROOFS ;
  Y                   :
                             =(
  Y                                                              );
     END :
```

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT MOST COLUMN. 2. CHARACTER SET (029/EBCDIC,026/BCD) 3. CONVENTIONS 1,0,S (ALPHA) : " (SPECIAL) 1,0,5 (NUMERIC)

BLAST INPUT FORM 4

Definition of construction elements – walls, roofs, floors, doors and windows

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO. 4/27

```
                    LIBRARY MODIFICATION BLOCK - SCHEDULE DEFINITIONS
DEFINE    SCHEDULE=(INFIL                                          ):
  SATURDAY=(00 TØ 24-1,
  SUNDAY  =SATURDAY,
  MONDAY THRU FRIDAY=(00 TØ 24-1),
  HOLIDAY =SUNDAY;
END SCHEDULE;
DEFINE    SCHEDULE=(ØFC EQUIP                                      ):
  SATURDAY=(00 TØ 24-0.1),
  SUNDAY  =SATURDAY,
  MONDAY THRU FRIDAY=(17 TØ 07-0.1,07 TØ 17-1),
  HOLIDAY =SUNDAY;
END SCHEDULE;
```

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT MOST COLUMN. 2. CHARACTER SET (026/EBCDIC,026/BCD) 3. CONVENTIONS 1,0,5 (ALPHA) : - (SPECIAL) 1,0,5 (NUMERIC)

BLAST INPUT FORM 5

Definition of internal load schedules

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO. 5/27

PUNCH	REQD	CARD TYPE	COLUMNS 1–72	OPTIONAL SEQUENCE NO.
		C	.. PROJECT DESCRIPTION BLOCK	
X	Y	PD1.1	PROJECT=" ENERGY ANALYSIS - LAB BUILDING" ;	
		PD1.2		
X	Y	PD2	LOCATION= TYNDALL AFB ;	
X		PD3.1	DESIGN DAYS=TYNDALL AFB SUMMER ,TYNDALL AFB WINTER;	
		PD3.2		
		PD4	WEATHER TAPE FROM THRU :	
X		PD5.1	GROUND TEMPERATURES=(63 ,68 ,72 ,75 ,78 ,81 ,	
X		PD5.2	80 ,79 ,79 ,72 ,65 ,58);	
		C	.. BUILDING DESCRIPTION BLOCK	
X	Y	BD1	BEGIN BUILDING DESCRIPTION;	
X		BD2	BUILDING= "LAB BUILDING";	
X		BD3	DIMENSIONS:H1=4.08,H2=3.0,H3=8.0,H4=13,N=0,E=90,S=180,W=270 ;	
X		BD4	NORTH AXIS= 36 ;	

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (026/EBCDIC,026/BCD) 3. CONVENTIONS 1,Φ,S (ALPHA) : " (SPECIAL) 1,0,5 (NUMERIC)

BLAST INPUT FORM 7

Project description and beginning of building description

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO

```
..
ZONE 1 - SE SECT                    ZONE DESCRIPTION BLOCK                    ;
    DIMENSIONS: A=59.7,B=29.8                                                 ;
    ORIGIN: X=100.58 , Y=0 , Z=0                                              ;
    NORTH AXIS =

    CONTROLS=NIGHT AND WEEKEND SETBACK WITH SINGLE THROTTLING RANGE
             63.3 HEATING,69.0 COOLING;
    PEOPLE=18 ,OFFICE OCCUPANCY
             AT ACTIVITY LEVEL .51 ,70 PERCENT RADIANT;
    LIGHTS=18.2 ,OFFICE LIGHTING
           50 PERCENT RADIANT,0 PERCENT RETURN AIR,0 PERCENT LOST;
    ELECTRIC EQUIPMENT=3.04 ,OFC EQUIP
           30 PERCENT RADIANT,0 PERCENT LATENT,0 PERCENT LOST;
    GAS EQUIPMENT=
           PERCENT RADIANT, PERCENT LATENT, PERCENT LOST;
    INFILTRATION=.193 ,INFIL
           WITH COEFFICIENTS
    BASEBOARD HEATING= ( AT , AT ), PERCENT RADIANT;
```

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (026 EBCDIC, 026 BCD) 3. CONVENTIONS 1,4,5 (ALPHA) : (SPECIAL) 1,0,5 (NUMERIC)

BLAST INPUT FORM 9

Description of simulation zones

ORGANIZATION ______ PROJECT NAME ______ DATE ______ ANALYST ______ PROJECT NO. 7/27

Punch	Req.	Card	Columns 1–80
		C	•• SURFACE DESCRIPTION BLOCK-WITHOUT SUBFEATURES
X	Y	501	PARTITIONS
X	Y	502	STARTING AT (A , B , D) FACING(N)
X	Y	503	PARTITION23 (A BY H4);
X		501	ROØF
X	Y	502	STARTING AT (O , O , H4) FACING(S)
X	Y	503	RF (A BY);
X		501	SLAB ØN GRADE FLØØR
X	Y	502	STARTING AT (O , B , O) FACING(S)
X	Y	503	SLAB (A BY B);
		501	
	Y	502	STARTING AT (, ,) FACING( )
	Y	503	(BY);
		501	
	Y	502	STARTING AT (, ,) FACING( )
	Y	503	(BY);
		501	
	Y	502	STARTING AT (, ,) FACING( )
	Y	503	(BY);
		501	
	Y	502	STARTING AT (, ,) FACING( )
	Y	503	(BY);
		501	
	Y	502	STARTING AT (, ,) FACING( )
	Y	503	(BY);
	Y	2015	END ZONE;
	Y	805	END BUILDING DESCRIPTION;
	Y	905	END INPUT;

KEYPUNCH INSTRUCTIONS 1. PUNCH ALL LINES WHICH HAVE X IN LEFT MOST COLUMN. 2. CHARACTER SET (029/EBCDIC,026/BCD) 3. CONVENTIONS 1,I,S (ALPHA) : – (SPECIAL) 1,6,5 (NUMERIC)

BLAST INPUT FORM 10

Definition of surfaces enclosing the zone

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO. 8/27

```
       C    ..                  SURFACE DESCRIPTION BLOCK-WITH SUBFEATURES
X  Y         WALLS TØ UNCØØLED SPACES :
X  Y               STARTING AT ( 0 , B , 0 ) FACING( N )
X  Y               PARTITIØN23                                  ( B BY H4 )
   Y               WITH
   Y                   (      BY      ) AT (      .      )
                                        AND(      .      )
                                        AND(      .      )
                   WITH
                       (      BY      ) AT (      .      )
                                        AND(      .      )
                                        AND(      .      )
X                  WITH OTHER SIDE COEFFICIENTS (1.96,1,1,0,0,0,0          );
   Y               STARTING AT (      .      .      ) FACING(    )
   Y                                                            (      BY      )
   Y               WITH
   Y                   (      BY      ) AT (      .      )
                                        AND(      .      )
                                        AND(      .      )
                   WITH
                       (      BY      ) AT (      .      )
                                        AND(      .      )
                                        AND(      .      )
                   WITH OTHER SIDE COEFFICIENTS (                      )
          END ZONE;
         END BUILDING DESCRIPTION;
        END INPUT;
```

KEYPUNCH INSTRUCTIONS 1. PUNCH ALL LINES WHICH HAVE X IN LEFT MOST COLUMN. 2. CHARACTER SET (029/EBCDIC,026/BCD) 2. CONVENTIONS I,1,S (ALPHA) : " (SPECIAL) 1,0,5 (NUMERIC)

BLAST INPUT FORM 10A

Definition of exterior walls with windows or attached shading, roofs with skylights, or surfaces with special other side conditions

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO. 9/27

```
        ..          SURFACE DESCRIPTION BLOCK-WITH SUBFEATURES
X Y  EXTERIOR WALLS
X Y        STARTING AT ( A , 0 , 0 ) FACING( E )
X Y        EXT WALL                                      ( B BY H4 )
X Y        WITH WINDOWS OF TYPE SINGLE PANE LW WINDOW
X Y            (10.2 BY H1 ) AT ( 0 , H2 );
                               AND(      ,      )
                               AND(      ,      )
           WITH
               (     BY     ) AT (      ,      )
                               AND(      ,      )
                               AND(      ,      )
           WITH OTHER SIDE COEFFICIENTS (                    )
X Y        STARTING AT ( 0 , 0 , 0 ) FACING( S )
X Y        EXT WALL                                      ( A BY H4 )
X Y        WITH WINDOWS OF TYPE SINGLE PANE LW WINDOW
X Y            (23.9 BY H1 ) AT (      ,      )
X                              AND( 0 , H2 )
                               AND(      ,      )
X          WITH WINDOWS OF TYPE SINGLE PANE LW WINDOW
X              (23.9 BY H1 ) AT ( 0 , H2 )
                               AND(      ,      )
                               AND(      ,      )
           WITH OTHER SIDE COEFFICIENTS (                    )
X     END ZONE;
     END BUILDING DESCRIPTION;
    END INPUT;
```

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (029/EBCDIC,026/BCD) 3. CONVENTIONS 1,Ø,S (ALPHA) : " (SPECIAL) 1,0,S (NUMERIC)

BLAST INPUT FORM 10A

Definition of exterior walls with windows or attached shading, roofs with skylights, or surfaces with special other side conditions

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO. 10/27

		C	** ZONE DESCRIPTION BLOCK
X	Y	Z01	ZONE 2 - NE SECT ;
X		Z02	DIMENSIONS: A=73, B=29.83 ;
X		Z03	ORIGIN: X= 87.33 , Y= 29.83 , Z= 0 ;
		Z04	NORTH AXIS = ;
X	Y	Z05 1	CONTROLS=NIGHT AND WEEKEND SETBACK WITH SINGLE THROTTLING RANGE
X		Z06 2	60.5 HEATING, 66 COOLING;
X		Z07 1	PEOPLE=22 .OFFICE OCCUPANCY
X		Z08 2	AT ACTIVITY LEVEL .51 , 70 PERCENT RADIANT;
X		Z09 1	LIGHTS=22.3 .OFFICE LIGHTING
X		Z10 2	50 PERCENT RADIANT, 0 PERCENT RETURN AIR, 0 PERCENT LOST;
X		Z11 1	ELECTRIC EQUIPMENT=3.72 .OFC EQUIP
X		Z12 1	30 PERCENT RADIANT, 0 PERCENT LATENT, 0 PERCENT LOST;
		Z13 1	GAS EQUIPMENT= .
		Z14 2	PERCENT RADIANT, PERCENT LATENT, PERCENT LOST;
		Z15 1	INFILTRATION= .
		Z16 2	WITH COEFFICIENTS . . . ;
		Z17 1	BASEBOARD HEATING= (AT , AT), PERCENT RADIANT;

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (026/EBCDIC, 026/BCD) 3. CONVENTIONS 1,0,5 (ALPHA) : " (SPECIAL) 1,0,5 (NUMERIC)

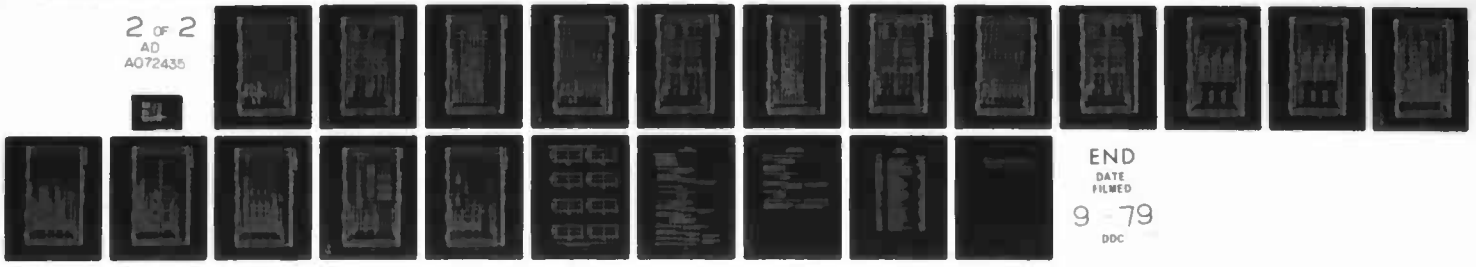
BLAST INPUT FORM 9

Description of simulation zones

AD-A072 435 CONSTRUCTION ENGINEERING RESEARCH LAB (ARMY) CHAMPAIGN IL F/G 9/2
THE BUILDING LOADS ANALYSIS SYSTEM THERMODYNAMICS (BLAST) PROGR--ETC(U)
JUN 79 E SOWELL

UNCLASSIFIED CERL-TR-E-154 NL

2 OF 2
AD
A072435



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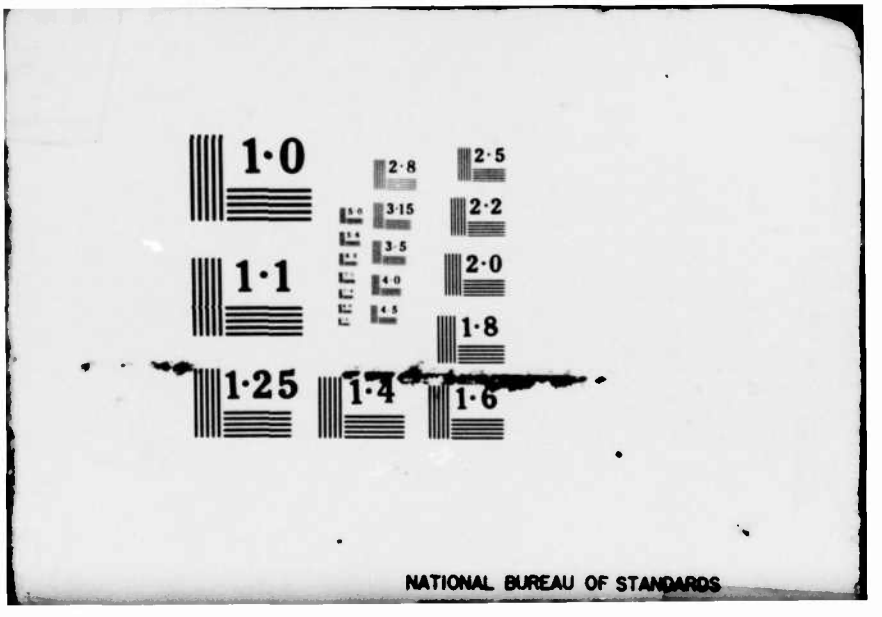
1·0
1·1
1·25
2·8
3·15
3·5
4·0
4·5
1·4
2·5
2·2
2·0
1·8
1·6
NATIONAL BUREAU OF STANDARDS

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO. 11/27

```
        SURFACE DESCRIPTION BLOCK-WITHOUT SUBFEATURES
PARTITIØNS
    STARTING AT ( 0 , 0 , 0 ) FACING( S )
    PARTITIØN23                              ( A BY H4 );
    STARTING AT ( 0 , B , 0 ) FACING( W )
    PARTITIØN23                              ( B BY H4 );
RØØF
    STARTING AT ( 0 , 0 , C ) FACING( S )
    RF                                       ( A BY B );
SLAB ØN GRADE FLØØR
    STARTING AT ( 0 , B , 0 ) FACING( S )
    SLAB                                     ( A BY B );
    STARTING AT (  ,  ,  ) FACING(  )
                                             (  BY  );
    STARTING AT (  ,  ,  ) FACING(  )
                                             (  BY  );
    STARTING AT (  ,  ,  ) FACING(  )
                                             (  BY  );
    STARTING AT (  ,  ,  ) FACING(  )
                                             (  BY  );
  END ZONE;
 END BUILDING DESCRIPTION;
END INPUT;
```

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT MOST COLUMN. 2. CHARACTER SET (029/EBCDIC,026/BCD) 3. CONVENTIONS 1,Ø,S (ALPHA) : ~ (SPECIAL) 1,0,6 (NUMERIC)

BLAST INPUT FORM 10

Definition of surfaces enclosing the zone

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO. 12/27

SURFACE DESCRIPTION BLOCK-WITH SUBFEATURES

```
   C    ..
XY 501  EXTERIØR WALLS
XY 502      STARTING AT ( A , B , 0 ) FACING( N )
XY 503      EXT WALL                                   ( A BY H4 )
XY 504      WITH WINDOWS OF TYPE SINGLE PANE LW WINDOW
XY 505          (23.9 BY H1 ) AT ( 0 , H2 )
     506                      AND(   .   )
     506                      AND(   .   )
     504    WITH
     505          (     BY    ) AT (       )
     506                      AND(   .   )
     506                      AND(   .   )
     507    WITH OTHER SIDE COEFFICIENTS (                          ),
XY 502      STARTING AT ( A , 0 , 0 ) FACING( E )
XY 503      EXIT WALL                                  ( B BY H4 )
XY 504      WITH WINDOWS OF TYPE SINGLE PANE LW WINDOW
XY 505          (6.82 BY H1 ) AT ( 0 , H2 )
     506                      AND(   .   )
     506                      AND(   .   )
X    504    WITH DOORS OF TYPE ALUMINUM DOOR
X    505          ( 1.5 BY H3 ) AT ( 0 , 8 );
     506                      AND(   .   )
     506                      AND(   .   )
     507    WITH OTHER SIDE COEFFICIENTS (                          )
X   2013  END ZONE;
     805 END BUILDING DESCRIPTION;
     NC8 END INPUT;
```

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (029/EBCDIC,026/BCD) 3. CONVENTIONS 1,Ø,S (ALPHA) : " (SPECIAL) 1,0,5 (NUMERIC)

BLAST INPUT FORM 10A

Definition of exterior walls with windows or attached shading, roofs with skylights, or surfaces with special other-side conditions

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO. 13/27

		C	* *
X	Y	Z01	ZØNE 3 , NW SECT ;
X		Z02	DIMENSIONS: A=87.33, B=27.08 ;
X		Z03	ORIGIN: X=0 , Y=32.58 , Z=0 ;
		Z04	NORTH AXIS = ;
X	Y	Z05.1	CONTROLS=NIGHT AND WEEKEND SETBACK WITH SINGLE THRØTTLING RANGE
X		Z05.2	107 HEATING, 117 COOLING;
X		Z06.1	PEOPLE=71 , ØFFICE ØCCUPANCY
X		Z06.2	AT ACTIVITY LEVEL ,78 , 70 PERCENT RADIANT;
X		Z07.1	LIGHTS=21.5 , ØFFICE LIGHTING
X		Z07.2	50 PERCENT RADIANT, 0 PERCENT RETURN AIR, 0 PERCENT LOST;
X		Z08.1	ELECTRIC EQUIPMENT=4.04 , OFC EQUIP
X		Z09.1	30 PERCENT RADIANT, 0 PERCENT LATENT, 0 PERCENT LOST;
		Z09.2	GAS EQUIPMENT=
		Z010.1	PERCENT RADIANT, PERCENT LATENT, PERCENT LOST;
X		Z010.2	INFILTRATION=256 , INFIL
		Z011	WITH COEFFICIENTS ;
			BASEBOARD HEATING= (AT , AT), PERCENT RADIANT;

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (026/EBCDIC,026/BCD) 3. CONVENTIONS 1@5 (ALPHA) : (SPECIAL) 1@5 (NUMERIC)

BLAST INPUT FORM 9
Description of simulation zones

ORGANIZATION ______ PROJECT NAME ______ DATE ______ ANALYST ______ PROJECT NO. 14/27

		C	•• SURFACE DESCRIPTION BLOCK-WITHOUT SUBFEATURES
X	Y	[illegible]	PARTITIØNS :
X	Y	[illegible]	STARTING AT (0 , 0 , 0) FACING(S)
X	Y	[illegible]	PARTITIØNS (A BY H4);
		[illegible]	:
X	Y	[illegible]	STARTING AT (A , 0 , 0) FACING(E)
X	Y	[illegible]	PARTITIONS (B BY H4);
X		[illegible]	ROOF :
X	Y	[illegible]	STARTING AT (0 . 0 . C) FACING(S)
X	Y	[illegible]	RF (A BY B);
X		[illegible]	SLAB ON GRADE FLOOR :
X	Y	[illegible]	STARTING AT (0 . B . 0) FACING(S)
X	Y	[illegible]	SLAB (A BY B);
		[illegible]	:
	Y	[illegible]	STARTING AT (. . ,) FACING( )
	Y	[illegible]	(BY),
		[illegible]	:
	Y	[illegible]	STARTING AT (. . ,) FACING( )
	Y	[illegible]	(BY),
		[illegible]	:
	Y	[illegible]	STARTING AT (. . ,) FACING( )
	Y	[illegible]	(BY),
		[illegible]	:
	Y	[illegible]	STARTING AT (. . ,) FACING( )
	Y	[illegible]	(BY),
	Y	[illegible]	END ZONE;
	Y	[illegible]	END BUILDING DESCRIPTION;
	Y	[illegible]	END INPUT;

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (026/EBCDIC,026/BCD) 3. CONVENTIONS 1ΦS (ALPHA) : - (SPECIAL) 1Φ5 (NUMERIC)

BLAST INPUT FORM 10

Definition of surfaces enclosing the zone

ORGANIZATION ____ PROJECT NAME ____ DATE ____ ANALYST ____ PROJECT NO. 15/27

OPTIONAL SEQUENCE NO

```
        ..
                    SURFACE DESCRIPTION BLOCK-WITH SUBFEATURES
X Y  EXTERIOR WALLS :
X Y        STARTING AT ( A , B , O ) FACING( N )
X Y        EXT WALL                                   ( A BY H4 )
X Y        WITH DOORS OF TYPE ALUMINUM DOOR
X Y            (8.5 BY 12 ) AT ( O , O )
                            AND(       ,      )
                            AND(       ,      )
           WITH
               (     BY     ) AT (      ,      )
                            AND(       ,      )
                            AND(       ,      )
           WITH OTHER SIDE COEFFICIENTS (                    ),
X Y        STARTING AT ( O , B , O ) FACING( W )
X Y        EXT. WALL                                  ( B BY H4 );
  Y        WITH
  Y            (     BY     ) AT (      ,      )
                            AND(       ,      )
                            AND(       ,      )
           WITH
               (     BY     ) AT (      ,      )
                            AND(       ,      )
                            AND(       ,      )
           WITH OTHER SIDE COEFFICIENTS (                    );
X      END ZONE;
     END BUILDING DESCRIPTION;
    END INPUT;
```

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (026/EBCDIC,026/BCD) 3. CONVENTIONS 1,Φ,S (ALPHA) : " (SPECIAL) 1,0,S (NUMERIC)

BLAST INPUT FORM 10A

Definition of exterior walls with windows or attached shading, roofs with skylights, or surfaces with special other-side conditions

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO. 16/27

Punch	Y	Card	Content
		C	.. ZONE DESCRIPTION BLOCK
X	Y	Z01	ZONE 4 - SW SECT "
X		Z02	DIMENSIONS: A=85.4, B=32.6 ;
X		Z03	ORIGIN: X=0 , Y=0 , Z=0 ;
		Z04	NORTH AXIS = ;
X	Y	Z05.1	CONTROLS=NIGHT AND WEEKEND SETBACK WITH SINGLE THROTTLING RANGE
X		Z05.2	99 HEATING, 108COOLING;
X		Z06.1	PEOPLE=83 , OFFICE OCCUPANCY
X		Z06.2	AT ACTIVITY LEVEL .78 , 70 PERCENT RADIANT;
X		Z07.1	LIGHTS=25.4 , OFFICE LIGHTING
X		Z07.2	50PERCENT RADIANT, 0 PERCENT RETURN AIR, 0 PERCENT LOST;
X		Z08.1	ELECTRIC EQUIPMENT=9.76 , OFC EQUIP
X		Z08.1	30 PERCENT RADIANT, 0 PERCENT LATENT, 0 PERCENT LOST;
		Z09.2	GAS EQUIPMENT= ,
		Z010.1	PERCENT RADIANT, PERCENT LATENT, PERCENT LOST;
X		Z010.2	INFILTRATION=301 , INFIL
		Z011	WITH COEFFICIENTS , , , ;
			BASEBOARD HEATING= (AT , AT), PERCENT RADIANT;

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (029/EBCDIC,026/BCD) 3. CONVENTIONS 1,0,S (ALPHA) : - (SPECIAL) 1,0,5 (NUMERIC)

BLAST INPUT FORM 9

Description of simulation zones

ORGANIZATION ____ PROJECT NAME ____ DATE ____ ANALYST ____ PROJECT NO. 17/27

Punch	Req	Code	Statement (columns 1–72)	Optional sequence no.
		C	** SURFACE DESCRIPTION BLOCK-WITH SUBFEATURES	
X	Y	301	WALLS TO UNCOLLED SPACES:	
X	Y	302	STARTING AT (A , 0 , 0) FACING(E)	
X	Y	303	PARTITION23 (8 BY H4)	
	Y	304	WITH	
	Y	305	(BY) AT (,)	
		306	AND(,)	
		306	AND(,)	
		304	WITH	
		305	(BY) AT (,)	
		306	AND(,)	
		306	AND(,)	
X		307	WITH OTHER SIDE COEFFICIENTS (1.46,1,1,0,0,0,0);	
	Y	302	STARTING AT (, ,) FACING( )	
	Y	303	(BY)	
	Y	304	WITH	
	Y	305	(BY) AT (,)	
		306	AND(,)	
		306	AND(,)	
		304	WITH	
		305	(BY) AT (,)	
		306	AND(,)	
		306	AND(,)	
		307	WITH OTHER SIDE COEFFICIENTS ( )	
		[illegible]	END ZONE;	
		905	END BUILDING DESCRIPTION;	
		RC0	END INPUT;	

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (029/EBCDIC,026/BCD) 3. CONVENTIONS 1,Ø,3 (ALPHA) : – (SPECIAL) 1,6,5 (NUMERIC)

BLAST INPUT FORM 10A

Definition of exterior walls with windows or attached shading, roofs with skylights, or surfaces with special other-side conditions

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO. 18/27

SURFACE DESCRIPTION BLOCK-WITHOUT SUBFEATURES

X	Y	PARTITIONS:
X	Y	STARTING AT (A , B , O) FACING(N)
X	Y	PARTITION23 (A BY H4);
X		ROOF:
X	Y	STARTING AT (O , O , C) FACING(S)
X	Y	RF (A BY B);
X		SLAB ON GRADE FLOOR:
X	Y	STARTING AT (O , B , O) FACING(S)
X	Y	SLAB (A BY B);
	Y	STARTING AT (, ,) FACING( )
	Y	(BY);
	Y	STARTING AT (, ,) FACING( )
	Y	(BY);
	Y	STARTING AT (, ,) FACING( )
	Y	(BY);
	Y	STARTING AT (, ,) FACING( )
	Y	(BY);
	Y	STARTING AT (, ,) FACING( )
	Y	(BY);
	Y	END ZONE;
	Y	END BUILDING DESCRIPTION;
	Y	END INPUT;

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (029/EBCDIC,026/BCD) 3. CONVENTIONS 1,Ø,S (ALPHA) : " (SPECIAL) 1,0,S (NUMERIC)

BLAST INPUT FORM 18

Definition of surfaces enclosing the zone

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO. 19/27

```
C  * *  SURFACE DESCRIPTION BLOCK-WITH SUBFEATURES
X Y 001  EXTERIOR WALLS :
X Y 002  STARTING AT ( 0, 0, 0 ) FACING( S )
X Y 003  EXT WALL                                  ( A BY H4 )
X Y 004  WITH DOORS OF TYPE ALUMINUM DOOR
X Y 005  (8.67 BY H3 ) AT ( 0. 0 )
         006  AND( .  )
         006  AND( .  )
         004  WITH
         005  (  BY  ) AT ( .  )
         006  AND( .  )
         006  AND( .  )
         007  WITH OTHER SIDE COEFFICIENTS (
X Y 002  STARTING AT ( 0. B. 0 ) FACING( W )
X Y 003  EXT WALL                                  ( B BY H4 ) ;
  Y 004  WITH
  Y 005  (  BY  ) AT ( .  )
         006  AND( .  )
         006  AND( .  )
         004  WITH
         005  (  BY  ) AT ( .  )
         006  AND( .  )
         006  AND( .  )
         007  WITH OTHER SIDE COEFFICIENTS (
X  2012  END ZONE;
X  005  END BUILDING DESCRIPTION;
   RCS  END INPUT;
```

OPTIONAL SEQUENCE NO

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (026/EBCDIC, 026/BCD) 3. CONVENTIONS I,Φ,S (ALPHA) : ~ (SPECIAL) 1,8,5 (NUMERIC)

BLAST INPUT FORM 10A

Definition of exterior walls with windows or attached shading, roofs with skylights, or surfaces with special other-side conditions

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO. 20/27

X	Y	Code	Statement
		C	FAN SYSTEM DESCRIPTION BLOCK
X	Y	FS1	BEGIN FAN SYSTEM DESCRIPTION;
X	Y	FS2	MULTIZONE SYSTEM "FAN SYSTEM"
X	Y	FS3.1	SERVING ZONES 1,2,3,4;
		FS3.2	
X	Y	FS4	FOR ZONE 1 : SUPPLY AIR VOLUME=2300 ;
		FS5	MINIMUM AIR FRACTION= ;
X		FS6	EXHAUST AIR VOLUME=1250 ;
		FS7	CAPACITY= ;
		FS8	ENERGY SUPPLY= ;
		FS9	ZONE MULTIPLIER= ;
X	Y	FS10	END ZONE;
X	Y	FS4	FOR ZONE 2 : SUPPLY AIR VOLUME=2200 ;
		FS5	MINIMUM AIR FRACTION= ;
X		FS6	EXHAUST AIR VOLUME=1625 ;
		FS7	CAPACITY= ;
		FS8	ENERGY SUPPLY= ;
		FS9	ZONE MULTIPLIER= ;
X	Y	FS10	END ZONE;
X	Y	FS4	FOR ZONE 3 : SUPPLY AIR VOLUME=3900 ;
		FS5	MINIMUM AIR FRACTION= ;
X		FS6	EXHAUST AIR VOLUME=625 ;
		FS7	CAPACITY= ;
		FS8	ENERGY SUPPLY ;
		FS9	ZONE MULTIPLIER= ;
X	Y	FS10	END ZONE;
	Y	FS11	END SYSTEM;
	Y	FS12	END FAN SYSTEM DESCRIPTION;
	Y	RC9	END INPUT;

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (026/EBCDIC,026/BCD) 3. CONVENTIONS 1,Φ,S (ALPHA) : " (SPECIAL) 1,0,5 (NUMERIC)

BLAST INPUT FORM 11

Fan system description

ORGANIZATION _____ PROJECT NAME _____ DATE _____ ANALYST _____ PROJECT NO. 21/27

	C		** FAN SYSTEM DESCRIPTION BLOCK
	Y	PS1	BEGIN FAN SYSTEM DESCRIPTION;
	Y	PS2	SYSTEM "
	Y	PS3.1	" SERVING ZONES
		PS3.2	
X	Y	PS4	FOR ZONE 4 : SUPPLY AIR VOLUME = 3600 ;
		PS6	MINIMUM AIR FRACTION = ;
X		PS6	EXHAUST AIR VOLUME = 2125 ;
		PS7	CAPACITY = ;
		PS8	ENERGY SUPPLY = ;
		PS9	ZONE MULTIPLIER = ;
X	Y	PS10	END ZONE;
	Y	PS4	FOR ZONE : SUPPLY AIR VOLUME = ;
		PS5	MINIMUM AIR FRACTION = ;
		PS6	EXHAUST AIR VOLUME = ;
		PS7	CAPACITY = ;
		PS8	ENERGY SUPPLY = ;
		PS9	ZONE MULTIPLIER = ;
	Y	PS10	END ZONE;
	Y	PS4	FOR ZONE : SUPPLY AIR VOLUME = ;
		PS5	MINIMUM AIR FRACTION = ;
		PS6	EXHAUST AIR VOLUME = ;
		PS7	CAPACITY = ;
		PS8	ENERGY SUPPLY ;
		PS9	ZONE MULTIPLIER = ;
	Y	PS10	END ZONE;
	Y	PS11	END SYSTEM;
	Y	PS12	END FAN SYSTEM DESCRIPTION;
	Y	ACO	END INPUT;

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (026/EBCDIC,026/BCD) 3. CONVENTIONS !,$,% (ALPHA) : - (SPECIAL) 1,8,6 (NUMERIC)

BLAST INPUT FORM 11

Fan system description

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO. 22/27

```
X  Y  OP1   OTHER SYSTEM PARAMETERS:
X     OP2      SUPPLY FAN PRESSURE= 2.28; SUPPLY FAN EFFICIENCY= .85 ;
         OP3   RETURN FAN PRESSURE=    ; RETURN FAN EFFICIENCY=    ;
X        OP4   EXHAUST FAN PRESSURE= .25 ; EXHAUST FAN EFFICIENCY= .80;
         OP5      COLD DECK            =
         OP6      COLD DECK THROTTLING RANGE=    .
         OP7      COLD DECK CONTROL SCHEDULE=(    AT    .    AT    ):
X        OP8   HEATING COIL ENERGY SUPPLY=HOT WATER; HEATING COIL CAPACITY= 380 ;
X        OP9      HOT DECK CONTROL    =OUTSIDE AIR CONTROLLED ;
         OP10     HOT DECK THROTTLING RANGE=    .
X        OP11     HOT DECK CONTROL SCHEDULE= (97 AT 30 . 70 AT 70 ):
X        OP12     MIXED AIR CONTROL=TEMPERATURE ECONOMY CYCLE ;
         OP13     DESIRED MIXED AIR TEMPERATURE=    ;
         OP14     OUTSIDE AIR VOLUME=    ;
         OP15     WEEKDAY MINIMUM OUTSIDE AIR SCHEDULE=(00 TO 24 -.083
X        OP16     WEEKDAY MAXIMUM OUTSIDE AIR SCHEDULE=(
X        OP17     WEEKEND MINIMUM OUTSIDE AIR SCHEDULE=(00 TO 24 -.083
         OP18     WEEKEND MAXIMUM OUTSIDE AIR SCHEDULE=(
         OP19     PREHEAT COIL LOCATION=    ;
         OP20     PREHEAT TEMPERATURE=    ;
         OP21     PREHEAT ENERGY SUPPLY=    ; PREHEAT COIL CAPACITY=    ;
         OP22     GAS BURNER EFFICIENCY=    ;
         OP23     VAV MINIMUM AIR FRACTION=    ;
         OP24     VAV VOLUME CONTROL=    ;
         OP25     FAN POWER COEFFICIENTS=(
         OP26  HUMIDIFIER TYPE=    ;HUMIDISTAT LOCATION=    ;HUMIDISTAT SET POINT=    ;
X  Y     OP27     END OTHER SYSTEM PARAMETERS;
   Y     FS11   END SYSTEM;
   Y     FS12 END FAN SYSTEM DESCRIPTION;
   Y     ECO  END INPUT;
```

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT MOST COLUMN. 2. CHARACTER SET (026/EBCDIC,026/BCD) 3. CONVENTIONS 1,4,5 (ALPHA) : (SPECIAL) 1,8,6 (NUMERIC)

BLAST INPUT FORM 12

Definition of other system parameters for fan systems (use for each fan system requiring non default other system parameters)

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO. 23/27

Punch	Req	Code	Columns 1–80
		C	•• COOLING COIL DESIGN PARAMETERS
X	Y	CC1	COOLING COIL DESIGN PARAMETERS:
X	Y	CC2	COIL TYPE = DX ;
X	Y	CC3	AIR VOLUME FLOW RATE = 12000;
X	Y	CC4	BAROMETRIC PRESSURE = 405 ;
X	Y	CC5	AIR FACE VELOCITY = 490 ;
X	Y	CC6	ENTERING AIR DRY BULB TEMPERATURE = 85 ;
X	Y	CC7	ENTERING AIR WET BULB TEMPERATURE = 64 ;
X	Y	CC8	LEAVING AIR DRY BULB TEMPERATURE = 55 ;
X	Y	CC9	LEAVING AIR WET BULB TEMPERATURE = 52.7 ;
		C	•• ADDITIONAL DATA FOR WATER TYPE COILS
	Y	CC10	ENTERING WATER TEMPERATURE = ;
	Y	CC11	LEAVING WATER TEMPERATURE = ;
	Y	CC12	WATER VOLUME FLOW RATE = ;
	Y	CC13	WATER VELOCITY = ;
		C	•• ADDITIONAL DATA FOR DIRECT EXPANSION COILS
X	Y	CC14	ENTERING REFRIGERANT TEMPERATURE = 40 ;
X	Y	CC15	LEAVING REFRIGERANT TEMPERATURE = 40 ;
X	Y	CC16	TOTAL COOLING LOAD = 360 ;
X	Y	CC17	NUMBER OF TUBE CIRCUITS = 20 ;
	Y	C	•• ADDITIONAL DATA FOR PACKAGED DX COILS
	Y	CC18	DXCOIL1( );
	Y	CC19	DXCOIL2( );
	Y	CC20	DXCOIL3( );
X	Y	CC21	END COOLING COIL DESIGN PARAMETERS;
	Y	FS11	END SYSTEM;
	Y	FS12	END FAN SYSTEM DESCRIPTION;
	Y	RC9	END INPUT;

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (029/EBCDIC, 026/BCD) 3. CONVENTIONS 1,Ø,S (ALPHA) : " (SPECIAL) 1,0,5 (NUMERIC)

BLAST INPUT FORM 13

Definition of cooling coil design parameters (use if default coils are not acceptable)

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO. 24/27

```
                                    DX CONDENSING UNIT PARAMETERS
DX CONDENSING UNIT PARAMETERS;
  DESIGN SATURATED SUCTION TEMPERATURE=40 ;
  DESIGN SATURATED CONDENSING TEMPERATURE=122 ;
  MINIMUM SATURATED CONDENSING TEMPERATURE=100 ;
  SCT TEMPERATURE RISE=2.53;
  DX CONDENSING UNIT CAPACITY=470 ;
  CONDENSER UA=27.49;
  DESIGN FULL LOAD POWER RATIO=.326;
  UNLOADER THROTTLING RANGE=36 ;
  RCAVCD (.9980 ,-.01272 ,.00006 );
  RPWRCD (.1456 ,.9559 ,-.10476 );
  ADJECD (.2984 ,.1334 ,34.603 );
END DX CONDENSING UNIT PARAMETERS;
                                    RELIEF AIR HEAT RECOVERY EQUIPMENT SPECIFICATIONS
HEAT RECOVERY PARAMETERS;
  HTREC1( ):
  HTREC2( ):
  HTREC3( ):
  HTPWR ( ):
  HEAT RECOVERY CAPACITY= ;
END HEAT RECOVERY PARAMETERS;
END SYSTEM;
END FAN SYSTEM DESCRIPTION;
END INPUT;
```

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (026/EBCDIC, 026/BCD) 3. CONVENTIONS 1.0.5 (ALPHA) : = (SPECIAL) 1.0.5 (NUMERIC)

BLAST INPUT FORM 14

Definition of DX condensing unit and relief air heat recovery parameters.

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO. 25/27

Punch		Form line	Input (columns 1–72)	Continuation	Optional sequence no. (76–80)
			FAN SYSTEM EQUIPMENT SCHEDULES		
X	Y		EQUIPMENT SCHEDULES:		
			FANS		
X			SYSTEM OPERATION=INTERMITTENT ;		
X			WEEKDAY SYSTEM SCHEDULE=(07 TØ 17-1, 17 TØ 07-0	);	
X			WEEKEND SYSTEM SCHEDULE=(00 TØ 24-0	);	
			HEATING COILS		
			HEATING CAPACITY ON FROM THRU ;		
			WEEKDAY HEATING SCHEDULE=(	);	
			WEEKEND HEATING SCHEDULE=(	);	
			COOLING COILS		
			COOLING CAPACITY ON FROM THRU ;		
			WEEKDAY COOLING SCHEDULE=(	);	
			WEEKEND COOLING SCHEDULE=(	);	
			PREHEAT COILS		
			PREHEAT CAPACITY ON FROM THRU ;		
			WEEKDAY PREHEAT SCHEDULE=(	);	
			WEEKEND PREHEAT SCHEDULE=(	);	
			HEAT RECOVERY UNITS		
			HEAT RECOVERY ON FROM THRU ;		
			WEEKDAY HEAT RECOVERY SCHEDULE=(	);	
			WEEKEND HEAT RECOVERY SCHEDULE=(	);	
	Y		END EQUIPMENT SCHEDULES;		
	Y		END SYSTEM;		
	Y		END FAN SYSTEM DESCRIPTION;		
	Y		END INPUT;		

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (029/EBCDIC, 026/BCD) 3. CONVENTIONS I, Ø, S (ALPHA) : - (SPECIAL) 1, 0, 5 (NUMERIC)

BLAST INPUT FORM 15

Fan system equipment schedules (use to control when fans are to be on regardless of load, and to specify when coil energy is available)

ORGANIZATION | PROJECT NAME | DATE | ANALYST | PROJECT NO. 26/27

Punch	Reqd	Line	Columns 1–72	Optional sequence no.
		C	•• CENTRAL PLANT DESCRIPTION	
X	Y	CP1	BEGIN CENTRAL PLANT DESCRIPTION;	
X	Y	CP2	PLANT 1 "CENTRAL PLANT "	
X	Y	CP3	SERVING SYSTEMS 1 ;	
		C	•• DOMESTIC HOT WATER DEMAND	
X		CP4	SCHEDULE:	
X		CP5.1	WEEKDAY HOT WATER=(21 TØ 08-0,10.7,10.7,9.7,10.7,17.5,11.6,	
X		CP5.2	15.5,13.6,14.6,5.82,5.82,9.7,0.97);	
X		CP6.1	WEEKEND HOT WATER=(100 TØ 24-);	
		CP6.2	);	
X		CP7	END SCHEDULE;	
X	Y	CP8	EQUIPMENT SELECTION:	
X	Y	CP9	1 BOILER OF SIZE 380 (1 AVAILABLE);	
		CP9	OF SIZE (AVAILABLE);	
		CP9	OF SIZE (AVAILABLE);	
		CP9	OF SIZE (AVAILABLE);	
X	Y	CP10	END EQUIPMENT SELECTION;	
		CP11	PART LOAD RATIOS:	
		CP12.1	(MIN= , MAX= , BEST=	
		CP12.2	, ELECTRICAL=);	
		CP12.1	(MIN= , MAX= , BEST=	
		CP12.2	, ELECTRICAL=);	
		CP12.1	(MIN= , MAX= , BEST=	
		CP12.2	, ELECTRICAL=);	
		CP12.1	(MIN= , MAX= , BEST	
		CP12.2	, ELECTRICAL=);	
		CP13	END PART LOAD RATIOS;	
		CP14	END PLANT;	
	Y	CP15	END CENTRAL PLANT DESCRIPTION;	
	Y	RC9	END INPUT;	

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (029/EBCDIC,026/BCD) 3. CONVENTIONS 1,Ø,S (ALPHA) : " (SPECIAL) 1,0,5 (NUMERIC)

BLAST INPUT FORM 16
Central plant descriptions

ORGANIZATION ____ PROJECT NAME ____ DATE ____ ANALYST ____ PROJECT NO. 27/27

Punch	Rec	Card type	Columns 1–72	Optional sequence no.
		C	** SPECIAL EQUIPMENT PARAMETERS	
X	Y	EP1	SPECIAL PARAMETERS: (omit if this form follows other SPECIAL PARAMETER FORMS)	
		EP2	TOTUEF= ; (omit if already given)	
		C	** BOILER PARAMETERS	
		EP3	RFLASH= ; RHFLASH= ; IMAKE= ;	
		EP4	TLEAVE= ; SRATB= ; HFUELB= ;	
X		EP5	PELHT=.0022 ;	
		C	** ABSORPTION CHILLERS	
		EP10	PSTEAM= ;	
		EP17	STEAM= ; (if omitted, will be calculated based on PSTEAM) TSATUR= ;	
		EP18	TMINC ; (used only with temp. correction)	
		EP21	TCOOL= ;	
		EP22	TTOWR= ;	
		C	** COOLING TOWER PARAMETERS	
		EP9	PELTWR= ; (used only if cooling tower not specified)	
		EP23	RWCA= ;	
		EP13	TOWOPR= ;	
		C	** OTHER SPECIAL PARAMETERS (use if required and end each with ;)	
		EP14		
		EP24		
		EP16		
		EP16		
		EP14		
	Y	EP15	END SPECIAL PARAMETERS; (omit if more SPECIAL PARAMETERS follow)	
		CP14	END PLANT; (omit if more central plants follow)	
X	Y	CP16	END CENTRAL PLANT DESCRIPTION;	
X	Y	RC9	END INPUT; (omit if other input follows)	

KEYPUNCH INSTRUCTIONS: 1. PUNCH ALL LINES WHICH HAVE X IN LEFT-MOST COLUMN. 2. CHARACTER SET (026/EBCDIC,026/BCD) 3. CONVENTIONS I,Ø,S (ALPHA) : – (SPECIAL) 1,0,5 (NUMERIC)

BLAST INPUT FORM 19

Central plant equipment parameters Boilers, absorption chillers and their cooling towers

APPENDIX: BLANK PROFILE FORM AND DEFAULT TABLES

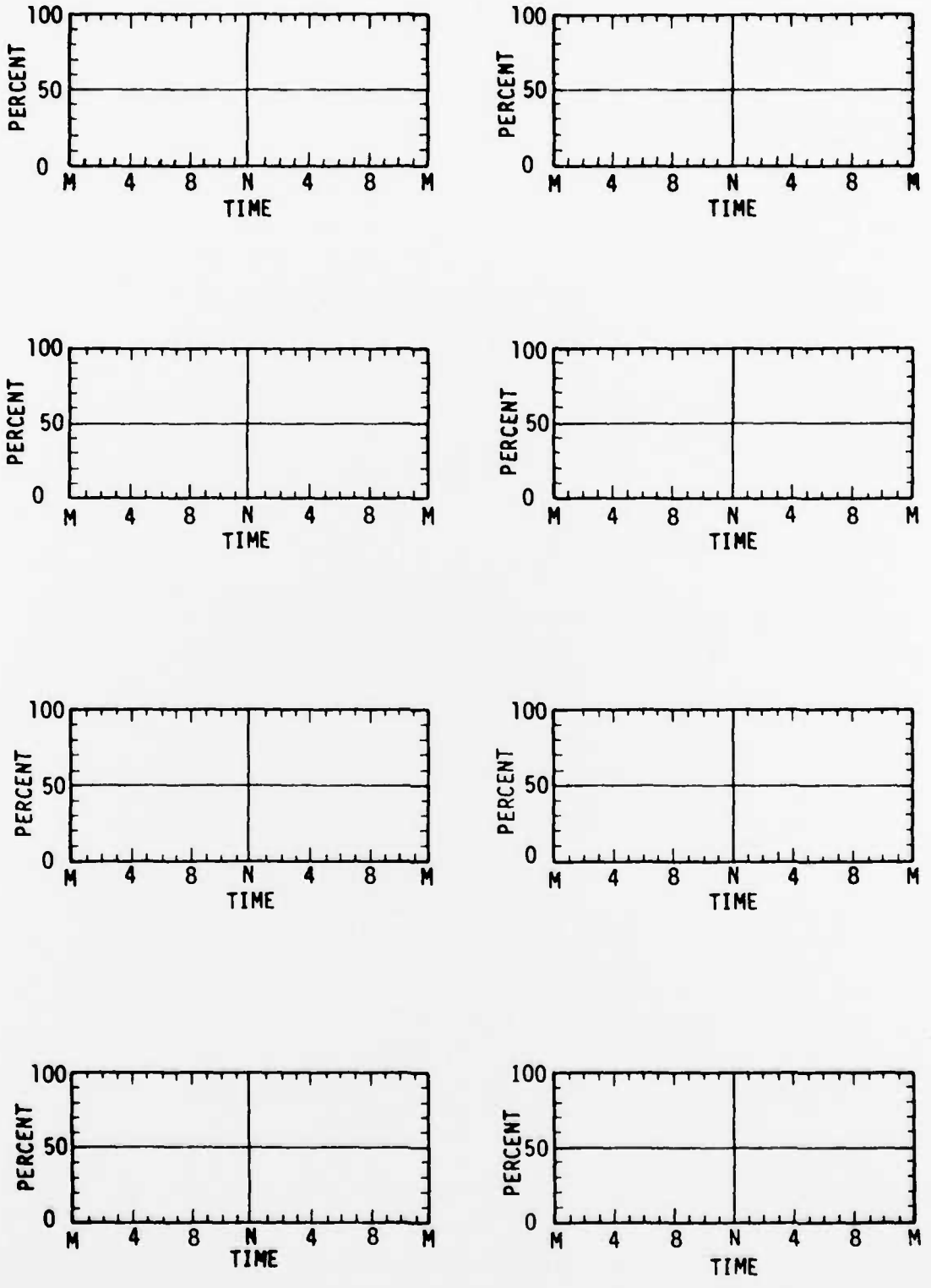

Figure A1. Sample profile (from *CAL-ERDA Users Manual*, ANL/ENG-77-03 [Argonne National Laboratory]).

Table A1
Other System Parameters

```
OTHER SYSTEM PARAMETERS
  SUPPLY FAN PRESSURE = 2.5;
  EXHAUST FAN PRESSURE = 1;
  RETURN FAN PRESSURE = 0.0;
  SUPPLY FAN EFFICIENCY = 0.7;
  EXHAUST FAN EFFICIENCY = 0.7;
  RETURN FAN EFFICIENCY = 0.7;

    COLD DECK CONTROL = FIXED SET POINT;  (default)
                   (or) = OUTSIDE AIR CONTROLLED;
                   (or) = ZONE CONTROLLED;

    COLD DECK TEMPERATURE = 55;
    COLD DECK THROTTLING RANGE = 7.2;
    COLD DECK CONTROL SCHEDULE = (55 AT 90, 65 AT 70);
                         (or) = (32 AT 32, 212 AT 212);  (if COLD DECK CONTROL =
                                                          ZONE CONTROLLED;)

    HEATING COIL CAPACITY = 3412000;
                        (in kBtu/hr [or kW])

    HEATING COIL ENERGY SUPPLY = HOT WATER;  (default)
                         (or) = GAS;
                         (or) = ELECTRIC;
                         (or) = STEAM;

    HOT DECK CONTROL = FIXED SET POINT;  (default)
                  (or) = OUTSIDE AIR CONTROLLED;
                  (or) = ZONE CONTROLLED;
    HOT DECK TEMPERATURE = 140;
    HOT DECK CONTROL SCHEDULE = (140 AT 0, 70 AT 70);
                         (or) = (32 AT 32, 212 AT 212);   (if HOT DECK CONTROL = ZONE
                                                          CONTROLLED;)
    HOT DECK THROTTLING RANGE = 7.2;
    MIXED AIR CONTROL = FIXED PERCENT;  (default)
                   (or) = FIXED AMOUNT;
                   (or) = TEMPERATURE ECONOMY CYCLE;
                   (or) = RETURN AIR ECONOMY CYCLE;
                   (or) = ENTHALPY ECONOMY CYCLE;

    DESIRED MIXED AIR TEMPERATURE = COLD DECK TEMPERATURE;  (default)
                         (or) = 50;  (a fixed temperature)

    OUTSIDE AIR VOLUME = 0.0;
    WEEKDAY MINIMUM OUTSIDE AIR SCHEDULE = (00 TO 24 - .15);
                               (or) = (00 TO 24 - 1);      (if MIXED AIR CONTROL =
                                                           FIXED AMOUNT;)
    WEEKEND MINIMUM OUTSIDE AIR SCHEDULE = (00 TO 24 - .05);
                               (or) = (00 TO 24 - 1);      (if MIXED AIR CONTROL =
                                                           FIXED AMOUNT;)
    WEEKDAY MAXIMUM OUTSIDE AIR SCHEDULE = (00 TO 24 - 1);
```

Table A1 (cont'd)
Other System Parameters

```
WEEKEND MAXIMUM OUTSIDE AIR SCHEDULE = (00 TO 24 - 1);

PREHEAT COIL LOCTION = NONE;  (default)
                     (or) = OUTSIDE AIR DUCT;
                     (or) = MIXED AIR DUCT;

PREHEAT TEMPERATURE = 46.4;
PREHEAT COIL CAPACITY = 0.0;
GAS BURNER EFFICIENCY = 0.8;

PREHEAT ENERGY SUPPLY = HOT WATER;  (default)
                      (or) = GAS;
                      (or) = ELECTRIC;
                      (or) = STEAM;

VAV MINIMUM AIR FRACTION = 0.1;
VAV VOLUME CONTROL TYPE = INLET VANES;  (default)     (Specify either VAV CONTROL TYPE
                        (or) = VARIABLE FAN SPEED;    or FAN POWER COEFFICIENTS)
                        (or) = DISCHARGE DAMPERS;

HUMIDIFIER TYPE = NONE;  (default)
                (or) = STEAM;
                (or) = HOT WATER;
                (or) = ELECTRIC;

HUMIDISTAT LOCATION = (  user specified zone number  );   (Humidity is added only when cooling
                                                          coil load is zero, i.e., during heating)
HUMIDISTAT SET POINT = 50;     (percent)
FAN POWER COEFFICIENTS = ( 0, 0, 0, 0, 0 );   (If FAN POWER COEFFICIENTS are specified, do not
END OTHER SYSTEM PARAMETERS;                  specify VAV VOLUME CONTROL TYPE)
```

Table A2
Special Parameters

Special Parameter Name	Special Parameter Description	Default Value (English)
AZMUTH	Collector Array Azimuth Angle	180.0000
FLOWRT	Mass Flow/Collector Area	9.2167
HFUELB	Heat Content of Fuel	20013.3845
HTXEFF	Tank-Collector Ht Excgr Effectiveness	.9000
MXTNKT	Maximum Solar Tank Temp	212.0000
PELCL	Elect Inp. to Circ. Pump/Cooling Load	.0180
PELHT	Elect Inp. to Circ. Pump/Heating Load	.0060
PELTWR	Elec Inp. to Tower/Tower Cool Load	.0130
PSTEAM	Steam Pressure	284.4099
PSTMTUR	Entering Steam Press	6920.1708
RAVRHDB	Availbl Recvrbl Ht Ratio	.9500
RAVRHHP	Availbl Recvrbl Ht Ratio	.9500
RFLASH	Boiler Flash Water/Steam Feed	.0710
RHFLASH	Recovd Heat/Flash Steam Energy	.5000
RMXKWD	Max Exh Flow/KW Output	1.4644
RMXKWG	Max Exh Flow/KW Output	11.7152
RPMNOM	Nom Speed, RPM	3600.0000
RWCA	Tower Water/Absor Chilr Capac	124.8226
RWCC	Tower Water/Compr Chilr Capac	124.8226
RWCDB	Tower Water/Dbund Chilr Capac	124.8226
RWCHP	Tower Water/Heat Pump Capac	124.2230
RWSTUR	Condensate/Entering Steam	.9700
SRATB	Air, Fuel Stoich Ratio	17.0000
STEAM	Steam Enthalpy	1168.6785
TNKTEM	Initial Tank Temperature	140.0000
TCOOL	Chilled Water Temp	44.0060
TCW	Leaving Condenser Water Temp	110.0000
TILT	Solar Collector Tilt Angle	40.0000
TLEAVE	Boiler Stack Leaving Temp	550.0400
TMINC	Min Tank Temp for Cooling	179.9960
TMINH	Min Tank Temp for Heating	100.0040
TMINHP	Min Tank Temp for Ht Pump	79.8800
TNKCAP	Storage Tank Cap/Col. Area	10.2408
TOTUEF	Tot Effic of Util Elec Generation	.3000
TOWOPR	Tower Operation Type	2.0000
TSATUR	Steam Saturation Temp	241.5302
TSTMTUR	Entering Steam Temp	572.0000
TTOWR	Minimum Leaving Tower Water Temp	60.0080
TWMAKE	Make Up Water Temp	55.0040

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